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### Essays on partial retirement

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# Essays on Partial Retirement

PROEFSCHRIFT

ter verkrijging van de graad van doctor aan Tilburg University op gezag van de rector magnificus, prof. dr. Ph. Eijlander, in het openbaar te verdedigen ten overstaan van een door het college voor promoties aangewezen commissie in de aula van de Universiteit op maandag 24 september 2012 om 10.15 uur door

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To my parents...

# Preface

This thesis could never have been written without the support of several people. Sybrand Schim van der Loeff inspired and personally encouraged me to pursue a Ph.D. degree during my M.Sc. study in Maastricht. The guidance and cooperation of Arthur van Soest have been invaluable during the course of this thesis. His contribution is not limited to this thesis, however. He introduced me to the subject of this thesis and I became passionate about it and hope to continue to do research on it for many years to come. Equally important is that the inspiration I received from his academic excellence will drive my future efforts in research. The lively conversations and discussions I have had with Bertrand Melenberg have also been encouraging during this study. The Netherlands Scientific Organization for Research (NWO), the Network for Studies on Pensions, Aging and Retirement (Netspar), and CentER in the Netherlands, and the RAND Corporation in the United States have facilitated my research. I am grateful to Arthur van Soest and Arie Kapteyn for allowing me to be a part of these distinguished institutions.

My sister has always made me feel at home in the Netherlands. My parents have always given me their unconditional support and encouraged me to pursue an academic career. This thesis can at best be a small attempt to express my gratitude for the support I received from them.

Tunga Kantarci  
Tilburg, August 2012

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# 1 Introduction

In the traditional retirement scenario individuals work full-time until a given age and then stop working in one abrupt step. This is referred to as abrupt retirement or sometimes also as “cliff-edge” retirement. In a partial retirement scenario on the other hand, individuals reduce their work hours and/or work effort in a gradual manner over several years before they move into full retirement. Partial retirement is also often called phased retirement or gradual retirement.

Partial retirement has been argued to benefit the individual or the economy for several reasons. One of these arguments is related to increasing life expectancy. A longer life expectancy probably means that people remain healthy and maintain their physical and mental capacity to work at older ages. This means that in the future individuals may want to work for more years to earn labor income and accrue additional pension rights. Several studies have shown, however, that many people dislike the idea of continuing the same job with the same effort after the normal retirement age, but are interested in continued participation in the labor market at a reduced effort level. Partial retirement plans allow people to reduce their work effort but remain in their jobs after their normal retirement age.

A second motivation for partial retirement is related to income smoothing. In the case of early retirement a worker is eligible only for occupational pension benefits and these benefits are substantially reduced due to early claiming. This results in a large gap in retirement income until the age the worker is eligible for state pension benefits. In such cases, partial retirement allows a worker to supplement his reduced occupational pension benefits with part-time work income until the age he starts to receive state pension benefits and to effectively smooth his consumption path through full retirement.

Partial retirement may also improve the well-being of people with health problems or health itself. It is shown that older people with disabilities are more likely to have a part-time job compared to their counterparts who are not disabled which suggests that part-time employment provides a means of increasing employment opportunities for older people with disabilities. This in turn could decrease the marginalization and poverty of vulnerable groups in society. On the other hand, working part-time may also help to limit the loss of cognitive skills which is recently shown to arise with full retirement by several studies.

Partial retirement can be beneficial for the employer too. It provides a soft form of personnel reduction and a cost-effective opportunity to retain people with valuable corporate knowledge and precious skills. Employers can use partial retirement as a means to increase productivity and reduce absenteeism by increasing job satisfaction. For firms with their own occupational pension fund, partial retirement may lead to longer contribution periods if workers continue contributing during partial retirement, and to lower average benefits if workers in partial retirement receive partial pensions. Partial retirement may also help to reduce the costs involved with worker exits through alternative exit routes, i.e. disability or unemployment. It is also argued that partial retirement could maintain or even enhance worker morale because a properly promoted partial retirement programme will be perceived

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as part of a natural evolution rather than a premature career termination.

For the macro-economy, partial retirement may extend the employment years by facilitating work after the effective retirement age or by restraining early withdrawal from the labor market, and sustain the pension system by extending the contribution periods and reducing the number of years during which full benefits are claimed. This also seems to be the main reason why many countries are currently considering ways to remove impediments to partial retirement, as part of a package of policy measures to increase retirement flexibility. Keeping older workers in the labor force is considered important not only for the size of the labor force, but also because older workers are generally well-qualified and productive, so that keeping them helps to keep productivity per worker at a high level.

The five essays in this dissertation address a range of topics in the micro-economic literature on partial retirement. The focus is on the labor market behavior of older age groups. In particular, the essays examine the economic and non-economic determinants of partial retirement behavior, the effect of partial retirement on retirement income and health, and the factors that could limit workers to participate in partial retirement. The analysis is mainly empirical and makes use of survey data on actual retirement opportunities and retirement decisions, but also on stated preferences concerning abrupt and partial retirement scenarios. The data are collected in the United States and the Netherlands through national surveys and through a web-based questionnaire specifically designed for the stated preference analysis. The empirical analysis relies on micro-econometric methods of discrete choice to estimate the empirical relationships between the variables of interest. The unit of analysis is usually an individual older than 40 years old. In the analysis throughout the dissertation, while our main interest lies in partial retirement, we also study the alternative, in fact the traditional, abrupt full retirement scenario. However, other alternative exit routes such as unemployment or disability are not analyzed in this dissertation. The essays are self-contained and have their own introductions. We briefly explain the motivation and provide a short summary of each essay below.

The economic literature on partial retirement has grown substantially in the last thirty years but no literature review has been published on the topic. Chapter 2 provides a review of the existing literature on partial retirement. It discusses concepts, measurement and prevalence of partial retirement. It then discusses worker preferences, advantages and disadvantages for employers, and institutional constraints. For an international perspective, it considers partial retirement in both the United States and a number of European countries. It also specifically looks at the Dutch situation and the relevance of partial retirement as a tool to keep people longer at work. In addition, it analyzes new survey data on the perceptions of Dutch workers of opportunities for partial retirement at their current employer. The findings indicate that participation in partial retirement is still low in most European countries compared to the United States and that employer-side restrictions and institutional restrictions imposed by the government or providers of pension plans play a role.

The economic well-being of older workers in retirement or the effectiveness of a pension system to replace pre-retirement earnings is often analyzed in terms of the replacement rates. In the literature, replacement rates are typically analyzed at the statutory retirement ages and only in the cases of abrupt full retirement. There is also limited information on

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how replacement rates change with the parameters of a given pension system and worker characteristics. Chapter 3 analyzes replacement rates and its economic determinants in a rich set of full and partial retirement scenarios. It assumes a hypothetical worker earning a certain level of income, entitled to a full state pension, and participating in the biggest occupational pension scheme in the Netherlands. It uses the actual rules and formulas of the occupational and state pension schemes and the Dutch tax system to calculate this worker's net work income and net future pension entitlement, and using these amounts, his net replacement rate in early and late retirement scenarios where a distinction is made between full and partial retirement. It then examines how the changes in the parameters of the tax and the pension systems and worker characteristics affect the levels of the replacement rates in these scenarios. It also analyzes the implications of certain rules of the tax and pension systems for the labor market participant and labor supply of older workers in these scenarios. Principle findings are the following. First, partial retirement results in a much smoother income path and provides a more self-reliant financial security in retirement compared to full retirement. Second, in the full retirement scenarios the replacement rates depend substantially on the underlying parameters of the pension system and on worker characteristics. In the partial retirement scenarios these changes are much less substantial. The chapter also shows how certain features of the current occupational pension system may unintentionally reduce labor force participation and labor supply due to taxes and benefits that are inherently linked to the occupational pension.

The economic models developed to explain the retirement decisions of older workers are typically estimated using data on actual retirement behavior from which it is difficult to identify the retirement options available to workers. This is a particular problem for partial retirement plans since employers often do not provide part-time work opportunities for older workers. Chapter 4 uses stated preference data to identify the preferences of individuals for full and partial retirement plans. It considers a choice set of hypothetical full and partial retirement plans and ask the respondents of a web-based survey to choose their favorite plan. It analyzes how the choices vary with financial incentives and economic and non-economic factors. Principal findings show that many people prefer partial retirement at the same job over early or late abrupt retirement and that financial incentives and disincentives affect partial or abrupt retirement decisions.

There is substantial interest in partial retirement among workers but few people participate in partial retirement. The large gap between the stated interest in partial retirement and the actual practice of it implies that certain labor market restrictions are keeping older workers from participating in partial retirement. Chapter 5 differentiates between various types of restrictions that might limit the access to partial retirement. It also considers different types of restrictions that might make partial retirement less attractive for workers. Respondents of a web-based survey to indicate the extent these restrictions apply in their own situation. The associations between these restrictions and worker characteristics, job characteristics and job satisfaction of the respondents are analyzed. The results show that higher income earners, those working in large companies, and blue-collar workers are limited in their opportunities for partial retirement. Older workers are much more likely but those with low job satisfaction are much less likely to be discouraged by the labor market restrictions that might make partial retirement less attractive.

## 1. INTRODUCTION

Recent studies analyzed the effect of retirement on mental and physical health. Some of them find that retirement yields a loss in cognitive skills while others find that retirement preserves physical health. These studies do not account for partial retirement or part-time work. Chapter 6 analyzes how working full-time and part-time affect the physical or mental health conditions of individuals between 50 and 75 years old in the United States. To avoid the potential bias due to the fact that deteriorating health conditions can cause workers to work fewer hours, retirement eligibility ages are used as instruments for part-time or full-time work decisions. The analysis also controls for, possibly health related, unobserved heterogeneity across individuals. The findings indicate that part-time or full-time work lowers overall health and memory skills, but leads to a much lower body mass index than full-time retirement. These health conditions respond much more to working part-time than to working full-time. This suggests that the effect of the number of hours worked on health is nonlinear.

## 2 Gradual retirement: Preferences and limitations

In the traditional retirement scenario, individuals work full-time or part-time until a given age, and then stop working abruptly. From the individual's point of view, it seems more attractive to have a smooth transition, with gradual retirement. In Sweden and other European countries, specific gradual retirement programs have been created in the past 20 years, first in combination with early retirement programs and later to increase labour market participation of older workers. This study surveys the existing literature on gradual retirement in the US and Europe and analyzes the relevance of gradual retirement in the Netherlands as a tool to keep people employed longer.

### 2.1 Introduction

In the traditional retirement scenario, individuals work full-time or part-time until a given age, and then stop working overnight. This fits with the notion of an institutionalized life course with separate stages of labour force preparation, participation and withdrawal (Kohli, 1986; Meyer, 1986; Mayer and Schoepflin, 1989). Labour market rigidities in terms of team production, fixed employment costs and social security incentives or age discrimination are factors that appear to have contributed to this segregation (Mayer and Müller, 1986; Hurd, 1996; Quinn, 1981).

It seems intuitively attractive from the point of view of the individual, however, to have a smooth transition from work to retirement, gradually reducing the number of hours worked. This is also in line with a more recent view on the life-course trajectory: Brückner and Mayer (2005) contended that the post-modern epoch identifies “patterns of a greater variety of partly freely chosen, partly imposed life trajectories.” Opportunities for gradual reduction of the working effort may also increase opportunities for working after the normal retirement age: many people dislike the idea of continuing the same job with the same effort after this age, but may well be interested in continued participation in the labour market at a reduced effort level.

Gradual withdrawal from the labour force can have two forms (see, e.g., Scott, 2004): either phased retirement (reducing work hours in the same job) or partial retirement (changing to a less demanding job with usually fewer hours and lower earnings). Each retirement path comes with its own income trajectories before, during, and after the transition process, with, for example, a combination of wages and a partial state pension and/or occupational pension during the period of gradual retirement.

In the United States, about 18% of the cohort of salaried workers born between 1931 and 1941 were in phased or partial retirement in 1998 and 2000 (Scott, 2004). In Europe, several gradual retirement programs have been created in the past 20 years, first in combination with early retirement programs and later as an attempt to increase the participation rate of the older part of the workforce. In the Netherlands in 2004, about one-third of former

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and current employees said their (last) employer offered the possibility of phased retirement (van Soest et al., 2006).

In order to design successful plans that are attractive to older workers, increasing their lifetime welfare, well-being, and contribution to society, it is essential to know the preferences of the workers as well as the considerations of their employers for offering or not offering gradual retirement. It is also essential to know the constraints imposed by state and occupational pension schemes. Institutional restrictions on combining earnings with pension income, or a pension system in which the pension level is determined by final earnings have been shown to severely limit the attractiveness of phased or partial retirement in the US (Chen and Scott, 2003).

The relevance of this topic for society and public policy seems obvious. Early retirement programmes and other exit routes that lead to early withdrawal from the labour market imply a burden for the macro-economy, magnified by the aging of the population, and are therefore at the top of the policy agenda in many countries. Gradual retirement has the potential to improve the lifetime utility of older workers while at the same time increasing labour supply and the sustainability of the pension system. A central issue is the ambiguous effect on total hours worked. Some workers who choose part-time work would otherwise have retired completely, but others would have kept working full-time. The total effect on labour supply depends on which of the two effects is larger.

This paper first surveys the existing micro-economic literature on gradual retirement. It discusses concepts, measurement and prevalence of gradual retirement. It then discusses worker preferences (supply), advantages and disadvantages for employers (demand), and institutional constraints. For an international perspective, the paper considers gradual retirement in both the US and a number of European countries.

The paper also specifically looks at the Dutch situation and the relevance of gradual retirement as a tool to keep people longer at work. Increasing the participation rate to 80% in 2016 is an explicit target of the Dutch government and the unions and employers' associations. While the rise in participation of prime age women has resulted in a rise in the overall participation rate in the past decades, this rise now seems to have come to a standstill (see Sect. 6), leaving increasing participation of the elderly as the main alternative. Gradual retirement may be an important tool to make this feasible.

In addition to the literature review, which gives insight in worker preferences, our paper analyses new survey data on the perceptions of Dutch employees of opportunities for gradual retirement at their current employer. Combining these with findings on preferences gives an indication of what is needed to increase the prevalence of gradual retirement and the participation rate of older workers.

The structure of the paper is as follows. Section 2.2 considers definitions and measurement issues. Section 2.3 describes the factors facilitating and obstructing gradual reduction of the work effort from the standpoint of both the employee and the employer, looking at theoretical arguments as well as survey evidence. Section 2.4 focuses on the empirical facts for the US, considering transitions into and out of gradual retirement, and discussing the correlates of gradual retirement identified in the literature. Section 2.5 looks at gradual retirement in Europe. Section 2.6 looks specifically at preferences for and access to gradual retirement in the Netherlands. Section 2.7 concludes.

## 2.2 Concepts and measurement

Traditional retirement is characterized by a structural break in the late life cycle – from full employment to complete retirement. In contrast, gradual retirement involves a time period during which work activity is reduced, implying a transition process rather than an instantaneous transition (Quinn, 1999). The transition into retirement may take various forms (Hayward et al., 1994). The reduction of work can imply a reduction of working hours, hourly wages, or both, in or outside the career job. Transitions are not always monotonic (from working more to working less), but may be reversible with, e.g., re-entry into a non-career job after spending some time outside the labour market (Hayward et al., 1994). The literature uses a wide range of indicators to identify gradual retirement. These include a reduction in working hours or earnings with an accompanying partial-pension benefit, a change in employer at age 55 or over (implying resignation from the career job), or a subjective qualitative assessment in the form of a self-report. Some measures also combine hours or earnings changes with self-reports (Ruhm, 1990; Scott, 2004), or wages with working hours (Honig, 1985).

Gradual, phased, partial and part-time retirement are all different terms used in this context. In this review gradual retirement is used as a generic term to define a gradual withdrawal from the labour market by reducing work effort. Phased retirement is progressive retirement while keeping the same employer within the same system, while partial retirement involves a change in employer.<sup>1</sup>

Phased retirement therefore does not involve change of employer. Examples include downsized work schedules, temporary assignments, consulting work, telecommuting, leave of absence and job-sharing (Reday-Mulvey, 1995; Flahaven, 2002; Chen and Scott, 2003). Partial retirement, on the other hand, involves a change of employer or a shift into self-employment, accompanied by a reduction in working hours or the wage rate (or both) (Gustman and Steinmeier, 1983, 1984b, 1986a; Honig and Hanoch, 1985; Scott, 2004).

Another term that is often used in this context is Part-time retirement, defined as at most 34 working hours per week by the US Bureau of Labor Statistics, or as fewer than 1600 h per year (Quinn, 1999), and involves a lower wage. It does not necessarily involve a change of job. A bridge job is defined as a change from the career job (with more than 10 years of tenure) to a new (usually less demanding) job or self-employment (Ruhm, 1990; Quinn and Kozy, 1996).

Phased and partial retirement are often discussed in relation to flexible retirement, which refers to flexibility in choosing the retirement age, but in the context of an abrupt end to labour force participation (Latulippe and Turner, 2000).

Measurement of gradual retirement draws upon the observed or stated labour market status. The former is a quantitative, objective realization of an event such as a reduction in weekly or annual working hours, a reduction in earnings, a change away from the life-long job, or receipt of a partial pension.

The latter is based upon a qualitative, subjective assessment by a survey respondent.

---

<sup>1</sup>The existing literature is not consistent in the use of terminology. For example, partial retirement is often used instead of phased retirement (Gustman and Steinmeier, 1985; Honig, 1985; Honig and Hanoch, 1985; Ruhm, 1990)

## 2. GRADUAL RETIREMENT: PREFERENCES AND LIMITATIONS

Surveys often ask the respondents to characterize their job, labour market position or job transition. Numerous objective and subjective measures of gradual retirement have been used in the literature. We briefly discuss them below.

### 2.2.1 Working Hours

A reduction of working hours is an indication of gradual retirement, although in some cases, the reduction may not be the choice of the worker (Ruhm, 1990). Several thresholds have been used to define part-time work and part-time retirement. The US Bureau of Labor Statistics' measure for a part-time job is at most 34 h per week. Empirical results appear insensitive to the thresholds (e.g., Blau, 1994). Others have defined part-time work on an annual basis. For example, Haider and Loughran (2001) and Scott (2004) used less than 1,750 – 35 h for 50 weeks. A rationale to use annual hours is that part-time work may appear as a reduction in weeks per year rather than in hours per week (Quinn, 1999).

### 2.2.2 Wage Rates

Partial retirement typically also involves a transition to a job with a lower wage rate and often has no pension coverage (Gordon and Blinder, 1980; Gustman and Steinmeier, 1982; Ghent et al., 2001). Quinn (1999)'s sample of US workers aged 51–65 in 1992–1996 reported a range of wage rates from \$5 to \$10 for 60% of the bridge jobs, but only for 33% of the career jobs. However, phased retirement can also be associated with a lower wage (Gustman and Steinmeier, 1982, 1984a).

### 2.2.3 Earnings

As a combination of the hourly wage rate and hours worked, earnings provide an attractive measure of gradual retirement. Gustman and Steinmeier (1984b, 2000b) defined gradual retirement as a more than 40% decline in both hours worked and earnings. In data from the early seventies, the peaks in the relative earnings – the ratio of current earnings to maximum earnings – distributions by age and year suggest an alternative threshold of 50% (Honig and Hanoch, 1985).

### 2.2.4 Pension Receipt

For private pension plans, a partial-pension receipt is an alternative measure of phased retirement. The percentage of the pension that is received is usually the same as the reduction in working hours (an individual reducing work hours by 30% would thus receive 30% of the pension benefits in phased retirement) (Latulippe and Turner, 2000; Brown, 2005). This measure is less useful in the US and several other countries, however, where gradual retirees usually do not have pension coverage (Ruhm, 1990; Honig and Hanoch, 1985).



## 2. GRADUAL RETIREMENT: PREFERENCES AND LIMITATIONS

### 2.2.5 Subjective Self-reports of Labour Market Status and Retirement Transitions

Self-reports have the advantage that they do not require researchers to make arbitrary distinctions between, for example, part-time and full-time work hours. Self-reports also preclude erroneous classification of individuals as partially retired due to involuntary reductions in wages, job demotion or displacement (Ruhm, 1990; Chen and Scott, 2006), and avoid problems due to missing data on hours, weeks or wage levels required to determine the retirement status (Gustman and Steinmeier, 1984a, 1986b). A problem with stated gradual retirement can be its inconsistency with objective measurements. For example, respondents report that they are in gradual retirement but have observed earnings at or near previous levels or have not held a job for a substantial amount of time before the survey (Honig and Hanoch, 1985; Gustman and Steinmeier, 1986b). Quinn (1981) compared the subjective account of partial retirement to objective measures, such as labour force status and annual hours worked and concludes that the self-evaluation is generally consistent with the quantitative indicators (see also Gustman and Steinmeier, 1984b), but the opposite has also been argued (Murray, 1979; Ruhm, 1991). Some studies define gradual retirement by supplementing subjective with objective measures on hours (Scott, 2004) or earnings (Ruhm, 1990).

## 2.3 Obstacles and benefits

### 2.3.1 Obstacles

As explained by Scott (2004), the fact that in the US phased retirement is less common than partial retirement suggests that workers face restrictions on phased retirement and often have to find a new job if they want to reduce their work effort. Many restrictions have been suggested in the literature, but there is not much empirical evidence on their quantitative importance.

Hurd (1996) summarized a number of reasons why employers are often reluctant to create opportunities for phased or partial retirement. The first is fixed employer costs, which can be overcome only if the number of working hours is substantial, unless hourly wages are reduced. This may sometimes be possible, but not always (e.g. due to agreements with unions). Another type of restriction is production technology and team production and the difficulty of job scheduling in case of part-time jobs. The third is that reducing hours may make it more difficult to retain job-specific skills (cf., e.g., Morris and Mallier, 2003). Investment in on-the-job training is less attractive to the employer for older workers than for younger workers, since workers approaching retirement will not stay with the firm long enough to make the investment pay off.

This also may explain why some employers are reluctant to hire older workers for jobs that require investing in on-the-job skills. Gustman and Steinmeier (1984b) already noted that phased retirement would be discouraged if earnings in a year in which the individual works part-time would be counted in determining the pension or social security benefit.

A specific financial incentive that makes gradual retirement less attractive is an earnings

## 2. GRADUAL RETIREMENT: PREFERENCES AND LIMITATIONS

test on old-age social security benefits that taxes away most of after-tax earnings in a part-time job (cf., e.g., Zweimüller, 1993; Ghent et al., 2001). For example, the US old-age social security benefits that people can claim between age 62 and the normal retirement age are reduced by 50% for every dollar of earnings above a given threshold, typically reducing the marginal net wage rate of working part-time by the same 50%. The rules of defined-benefit pension plans are often particularly restrictive.

They may, for example, prohibit workers to work for and receive a pension from the same employer at the same time (Chen and Scott, 2003; Forman and Scahill, 2003). Finally, health insurance may hamper phased or partial retirement or job changes of older workers, particularly if the worker has a chronic health problem (Hurd, 1996).

Hutchens and Grace-Martin (2004) showed that restrictions on phased retirement perceived by white-collar workers in the US vary across industries, and that small organizations are more likely to offer phased retirement than larger organizations. Opportunities are largest in health, education, and social services, but are low in the (other parts of the) public administration sector. Expanding establishments offer phased retirement more often than other firms and unionisation reduces phased retirement possibilities (perhaps due to lower downward wage flexibility or reluctance to reduce pension rights; see Smolkin, 1996).

Smolkin (1996) presented the results of a survey among Western European personnel executives, asking them which problems they judged to be major obstacles in introducing alternative work patterns, including phased retirement. The results showed a close finish between several reasons, including “hidden extra costs” (named by 32% of the respondents), “inadequate commitment by top management” (31%), “production problems” (30%), “union opposition” (30%), “human problems and reactions” (28%), “resistance by lower and middle management” (28%) and “inadequate briefing/training to show employees how to take advantage” (27%). Only 18% named “lack of support from the workforce.”

### 2.3.2 Benefits

The literature emphasizes the benefits of partial and phased retirement for employees and for the macro-economy as a whole, but also mentions advantages for employers. For employees, gradual retirement “constitutes a way of avoiding the pension shock following an abrupt transition from full-time work to full pensioning” (Reday-Mulvey and Delsen, 1996). It reduces stress and increases job satisfaction (Reday-Mulvey, 2000). It gives the worker an opportunity to benefit from continued membership in a work team, while also providing the free time to develop activities outside work.

Similarly, for employers it provides a soft form of personnel reduction and a cost-effective opportunity to retain people with valuable corporate knowledge and precious skills. Employers can use partial and phased retirement as a means to reduce adjustment costs (Ghent et al., 2001) and to increase productivity and reduce absenteeism by increasing job satisfaction (Reday-Mulvey, 2000). For firms with their own occupational pension fund, phased retirement may lead to longer contribution periods if workers continue contributing during phased retirement, and to lower average benefits if workers in phased retirement receive partial pensions. Phased retirement may also help to reduce the costs involved with worker exits through alternative exit routes, i.e. disability or unemployment (Reday-Mulvey and

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Delsen, 1996). Smolkin (1996) argued that phased retirement could maintain or even enhance employee morale because a properly promoted phased retirement programme will be perceived as part of a natural evolution rather than a premature career termination.

The macroeconomic benefits focus on labour force participation and the labour supply of older workers. Wadensjö (2006) distinguished three goals in this context: decrease early exit, increase the formal retirement age (or the minimum age for getting an old-age pension), and facilitate work after the normal retirement age. Keeping older workers in the labour force is considered important not only for the size of the labour force, but also because older workers are generally well-qualified and productive, so that keeping them helps to keep productivity per worker at a high level (Mulvey, 2005). This is in stark contrast with age discrimination because older workers would be too expensive and less productive.

### 2.4 Empirical analysis of gradual retirement in the US

This section first discusses the prevalence of gradual retirement, considering incidence, transition probabilities, sequences and durations. It then reviews the literature on the background characteristics that are correlated with gradual retirement, using the terminology introduced in Section 2.2.

The empirical literature in the US is based mainly upon a few surveys. The Retirement History Study (RHS; see, for example, Ireland, 1988) interviewed men and unmarried women aged 58–63 in 1969 in six biennial waves. The study provided only subjective information on whether the main job offered an opportunity for gradual retirement (Gustman and Steinmeier 1984b). The Health and Retirement Study (HRS) is an ongoing study that began with an interview of the cohort aged 51–61 in 1992 and has by now seven biennial waves. Unlike the RHS, it includes also married women. Other cohorts were added later to the study. The RHS and HRS cover retirement, labour force history, demographics, health, income, etc. The National Longitudinal Survey of Older Men (NLS) surveyed men aged 45–59 initially in 1966, and then about every other year, until 1981. The topics included non-work and work experiences, health and health insurance, leisure time, and labour market decisions (including job changes, retirement, and re-entry).

A drawback of the biennial surveys is the limited information on job and labour supply mobility between waves (Blau, 1994). The Current Population Survey (CPS) is a monthly survey of household members aged 15 and over, which has been conducted for more than 50 years. Interviews include questions on labour force characteristics, such as work experience, schedules, benefits and earnings, as well as demographic and institutional characteristics. The Retirement Confidence Survey (RCS) is an annual study that began in 1991 on individuals over the age of 25, and explores saving behaviour, retirement, and long-run financial security. The Panel Study of Income Dynamics (PSID) is a longitudinal study of a representative sample of US individuals and their families. In recent years, special supplemental datasets were constructed.

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### 2.4.1 Incidence of gradual retirement

Of the employees in the HRS who had at least 10 years of tenure, 14.5% held a bridge job in 1992. This increased to 29.3% in 1998 and then fell to 25.3% in 2002 (Cahill et al., 2006). During the first four waves of the HRS, the share of gradual retirees continuously rose with age, to about 20% at age 64 (Gustman and Steinmeier, 2000b). (Scott, 2004) found that in the HRS sample, phased retirement decreased from 7.5 in 1994 to 4.1, 4.2 and 1.3% in 1996, 1998 and 2000, respectively, while partial retirement rose from 3.7 to 5.5, 13.4 and 15.5%.

Expectations of and interest in gradual retirement, as stated by current employees, seem to exceed the actual gradual retirement rates. In a web survey in 2005, 38% of employees expressed an interest in gradual retirement (Brown, 2005). A 1999 AARP survey suggested that about 80% of baby boomers aged 33–52 expected to work at least part-time during their retirement, mainly because staying at work is intrinsically interesting (35%) or because of the extra income (23%; Roper Starch Worldwide, 1999). In the 1998 RCS survey, 61% of employees expressed an interest in working after retirement, most of them to improve the quality of their lives and some for their financial situation (Yakoboski et al., 1998, Clark and Quinn, 2002).

### 2.4.2 Transitions

Table 2.1 summarizes Figure 3 in Scott (2004).<sup>2</sup> It merges transitions between consecutive waves (1992–1994, 1994–1996, 1996–1998 and 1998–2000) in the HRS cohort born 1931–1941 of those who were salaried workers in 1992 (4,721 individuals; 14,163 transitions). The table distinguishes four labour market states (full-time work, partial retirement, phased retirement and full retirement) and combines data on number of hours worked and self-reported labour force status.<sup>3</sup>

The most common transition to a different labour market state is from full-time work to full-time retirement (2,686 transitions). Almost 38% of all full-time workers are fully retired in the next wave. Almost 49% are still working full-time. The others enter partial or phased retirement. Of full-time workers who have stopped working full-time 2 years later, almost one of every ten stay with the same employer with reduced work effort (phased retirement), and almost two in ten change to another job (partial retirement). The other seven have gone into full-time retirement.

Workers typically do not stay long in partial or phased retirement. Only about one in every four workers observed in gradual retirement was still in gradual retirement 2 years later. Surprisingly, many of them went back to full-time work, particularly if they had been in phased retirement (a 38% transition rate). This makes the number of transitions from phased retirement to full-time work larger than the number of transitions from phased retirement to full-time retirement. Scott (2004) provides no explanation for this unexpectedly large number of transitions back into full-time work. Similarly, we find many transitions from full-time retirement to gradual retirement or full-time work. Almost one in every three

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<sup>2</sup>Other studies, such as Gustman and Steinmeier (2000b), have shown similar transition rates, but usually for the earlier data only and with different labour market state definitions and samples.

<sup>3</sup>Transitions from partial retirement or full retirement into phased retirement are not possible by construction.

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**Table 2.1**

Transitions in the HRS, 1994-2000

		To				Total
		Full-time work	Phased retirement	Partial retirement	Full retirement	
From	Full-time work	48.63	4.48	9.05	37.85	100
	Phased retirement	38.00	18.80	7.73	35.47	100
	Partial retirement	28.40	—	24.46	47.14	100
	Full retirement	22.27	—	12.59	65.14	100

Source: Scott (2004, Figure 3). Sample of salaried workers in 1992; 4,721 observations. Number of transitions in % of number in origin state. For example, on average over the four 2-year periods, 48.63% of those working full-time at a given point in time are still working full-time 2 years later.

fully retired workers is no longer fully retired 2 years later. Of those who returned to work, more than a third worked fewer hours than before they retired, and are thus categorized as partially retired. Measurement error might explain part of the large number of transitions, but other research suggests that many of these “reverse transitions” are real. Maestas (2007) reports that slightly less than half of all workers follow a traditional retirement pattern without “reverse retirement.”

All in all, the transition matrix in Table 2.1 illustrates the substantial mobility in the labour market for older workers in the US. In particular, retirement is not at all an absorbing state (in the sense that people who are once retired never return to work), and gradual retirement is usually not held for a long time, with many exits not only to full retirement but also back to full-time work. In Section 2.5 we will compare this with transition patterns in European countries.

### 2.4.3 Sequences

Sequences refer to particular retirement pathways, summarizing behaviour over a larger part of the life cycle. Three types of sequences can be distinguished. The first is an instantaneous exit from career employment into retirement, without gradual retirement. The second is a three-step sequence: career job employment – gradual retirement (partial or phased) – full retirement. The third category consists of all sequences that are non-monotonic, in the sense that they include transitions from gradual retirement to full-time work or from full retirement to gradual retirement (or both).

Gustman and Steinmeier (2000b, Table 7) presented the sequences over the 6 years spanned by the first four waves of the HRS (1992–1998; cohort born 1931–1941).<sup>4</sup> Four self-reported labour market states are distinguished: full-time work, full retirement, gradual retirement and “not available.”<sup>5</sup> These sequences are incomplete, in the sense that many respondents had not yet retired in 1998, explaining why 24.7% were continuously in full-

<sup>4</sup>Blau (1994) presented an overview of sequences in the older RHS cohort, but these are difficult to compare with those of Gustman and Steinmeier since the HRS cohort is observed at a younger age.

<sup>5</sup>This includes those who refused to answer or answered “don’t know” to the question on labour market status, proxy interviews for respondents who were not able to answer the questions, and respondents who dropped out of the survey.

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time employment over the four waves. On the other hand, 8.0% were completely retired in all four waves. Partial retirement occurred at least once in about 22% of all sequences. In 8.9% of all sequences, the transition pattern was monotonic without partial retirement, with one transition from full-time work to fulltime retirement. The results also confirm the importance of reverse transitions: in about 14% of all sequences, a “reverse transition” took place, from full to partial retirement or from full- or partial retirement to full-time work.

### 2.4.4 Durations

Gustman and Steinmeier (1984a, 2000b) found estimates of the average duration in gradual retirement of 2.55 years in the HRS and 2.76 years in the older RHS data. In contrast, Sueyoshi (1989) estimated a much longer average duration using the RHS, using a different definition of gradual retirement. Sueyoshi (1989, Table2) found that in the RHS, direct retirees left full employment at an average age of 64.8 years. Gradual retirees went into gradual retirement at an average age of 64.7, and then fully withdrew from the labour market at age 69.8 (on average), much later than the normal retirement age. This suggests that gradual retirement induces many workers to remain in the labour market for about five more years. For the OECD as a whole, Reday-Mulvey and Delsen (1996) also reported that the period of gradual retirement typically lasts about 5 years.

Depending on when it starts and on its duration, gradual retirement may extend employment beyond the normal retirement age. Scott (2004, Table 10) addressed the same issue in a different way. He found that (keeping age and other variables constant) phased retirees are less likely to leave the labour force than full-time workers, although the difference is significant only at the 11% level.

### 2.4.5 Correlates of gradual retirement

Several studies have analysed how preferences for phased or partial retirement in the US vary with background variables. Gustman and Steinmeier (1984b), Honig and Hanoch (1985) and Sueyoshi (1989) used RHS data for this analysis. Here, we focus on three studies that have used the more recent data from the HRS.

Quinn and Kozy (1996) studied transitions between the 1992 and 1994 waves of the HRS. He considered full-time workers in 1992, and estimated a logit model for holding a bridge job in 1994. He found that transitions to a bridge job are significantly more likely for workers aged 63–65 and for construction workers, and less likely for the self-employed, for those with the highest education level, for home-owners, and for those who have children living with them. He found no independent effect of health on the probability to get a bridge job, but he did find a smaller probability to enter a bridge job for employees who would lose their health insurance and for employees with an employer provided pension plan (irrespective of whether or not they were of eligible age). Both findings are in line with what one would expect, since losing health insurance or the opportunity to build up an occupational pension reduces the attractiveness of moving to another (bridge) job.

Ekerdt et al. (1996) analysed retirement plans in the HRS 1992, distinguishing five categories (stop working altogether, reduce effort, change job, never stop, or having no plans) and using multinomial logit analysis. They found that women are less likely to

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take gradual retirement than men. The tendency to reduce hours rather than change jobs increases with age. Both reducing hours and changing jobs are more prevalent for the higher than for the lower education levels. The self-employed are more likely to reduce hours, in line with the notion that they face fewer market restrictions. Entitlement to a private pension increases the tendency to stop working altogether, at the cost of all other alternatives. Being married also increases the odds to stop working altogether.

Kim and DeVaney (2005) explored the transition from full-time work in 1992 to full-time work, gradual retirement or complete retirement in 2000. They found that the self-employed have a higher probability of gradual retirement, probably because of more flexibility in determining their own working hours. Unlike other studies, they did find a health effect: those with more chronic conditions are more likely to reduce hours. The likelihood of gradual retirement also rose with age and education. They found that DB pension entitlement and investment assets increase the probability of full retirement, but do not change the odds of gradual retirement versus full-time work. They concluded that retirement decisions are sensitive to financial incentives (like pension plans), which creates scope for public policy.

The findings that DB pensions make partial retirement less likely and that the self-employed are more likely to take phased retirement are in line with the earlier studies based upon the RHS. These findings illustrate the importance of institutional restrictions on combining a DB-pension receipt with continued work, and employer-imposed restrictions on working part-time.

### 2.5 Gradual retirement in Europe

Several studies have provided overviews of partial retirement arrangements in Europe. Delsen (1996) is an early example. Describing policies in Denmark, Finland and Sweden, he concluded that only the Swedish programme could be called successful, in the sense of reducing the number of early withdrawals from the labour force. The Swedish partial-pension scheme was introduced in 1976, with a generous partial pension in combination with work for workers of 60 years and older. Several substantial changes in generosity were introduced in later years. Both the government and the employers supported the Swedish scheme, which was seen as a means of reducing labour costs during an economic recession. The crucial condition to make it a success was an adequate supply of part-time jobs. This condition was met, since Swedish firms were already familiar with organizing part-time employment and willing to share the responsibility of society to guarantee employment to older workers. An important attraction for employees is that the Swedish scheme counts the partial pension as pensionable income so that taking up a partial pension does not affect the old age pension (Wadensjö, 2006, p. 31). The Swedish system was abolished in 2001, but a new scheme was introduced in 2003. The current system entitles workers older than 61 to reduce working hours by as much as 50%, and to draw 100, 75, 50 or 25% of the full pension (Belloni et al., 2006). Wadensjö (2006) studied the Swedish partial-pension scheme in detail. He exploited changes in the system to analyse its consequences for participation and labour supply. Although he did not estimate any econometric models but merely looked at the raw data, he concluded that the positive effect of increased participation clearly outweighs the negative effect of full-time workers reducing their hours to part-time, so that the total effect of the

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partial-pension programme on labour supply is positive.

The Danish system introduced in 1987 applies to workers between the ages of 60 and 65 satisfying some conditions concerning their past participation (and, for the self-employed, profits; see Belloni et al., 2006). They can reduce their working hours and receive a partial pension proportional to the reduction in working time. Although the Danish scheme was modelled after the Swedish model, it was much less successful. Delsen (1996) argued that this was due mainly to the unfavourable labour market at the time of its introduction – a severe recession, with pressure on older workers to take full rather than phased retirement.

A similar argument explains the lack of success in Finland, where a partial pension scheme was introduced in 1987. The current rules allow workers between the ages of 58 and 67 to reduce their working hours to 16–28 h per week and replace 50% of foregone earnings by a partial pension (Belloni et al., 2006). Other reasons why the Finnish system was not successful were that the Finnish system is more complicated and part-time jobs were hard to find (Delsen, 1996).

Belloni et al. (2006) also describes gradual retirement arrangements in Spain (existing since the 1960s), France (since 1988) and Germany (since 1992). These systems all allow workers of age 60 or 61 and older to reduce working time and receive a corresponding partial pension (conditional on having contributed a long enough time to the social security system). According to Reday-Mulvey (2000), it seems that the programmes in France and Germany were successful as a substitute for very generous schemes of early complete retirement. She emphasizes the key role of training older workers, which is commonly done in Sweden and in the larger companies in France.

The countries discussed above are the only countries that have an explicit arrangement for combining part-time work with a part-time pension, but Reday-Mulvey (2000) found that most EU countries have introduced schemes that make it possible to combine work and pension receipt. The situation in the Netherlands is rather complicated, due to the variety of occupational pension schemes with their own rules. Belloni et al. (2006, p. 12) stated that “some of these schemes allow workers at the end of their careers to reduce their working hours and receive a partial pension.”<sup>6</sup> Delsen (1996) also described some tendencies toward partial retirement opportunities in the Netherlands, which he identified as a promising way to cope with the problem of ageing, raising the effective retirement age and easing future fiscal problems.

Morris and Mallier (2003) analysed the importance of part-time work and self-employment among older age groups for the EU-15. They found that in many countries, part-time work among men is much more prevalent at ages 60–64 and 65–69 than at earlier ages, although there is huge variation across countries. In particular, in the Northern part of Europe, part-time work among men is common, while in the Southern European countries, self-employment is more prevalent.

### 2.5.1 Part-time work in Europe

Whether employees in European countries prefer to reduce their work effort as they age can be inferred from comparing part-time employment rates among younger and older workers.

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<sup>6</sup>On p. 22, Belloni et al. (2006) have replaced “some” by “many”.



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**Table 2.2**

Part-time work of total employment (%)

	1994		1998		2001	
	35-50	51-65	35-50	51-65	35-50	51-65
Men						
Germany	2.1	7.3	2.3	8.6	2.8	2.8
Denmark	2.5	6.8	2.4	8.0	2.1	4.8
Netherlands	4.6	13.4	5.3	11.6	5.7	10.4
Belgium	2.3	6.9	1.7	5.2	0.8	(5.1)
France	5.8	9.4	1.3	(3.9)	1.3	3.6
UK	5.1	8.9	2.5	6.4	2.5	4.8
Ireland	5.3	8.8	5.7	12.0	5.3	11.9
Italy	5.9	10.4	2.1	5.7	1.6	4.1
Greece	6.6	9.0	2.1	2.6	1.2	2.8
Spain	3.7	6.5	1.9	3.4	2.2	2.9
Portugal	3.0	9.0	1.3	6.8	1.1	5.3
Austria	<i>0.7</i>	<i>3.5</i>	1.8	(4.2)	1.9	5.8
Finland	<i>3.3</i>	<i>8.5</i>	3.2	9.0	3.1	7.5
Sweden	<i>2.3</i>	<i>6.4</i>	1.7	6.2	1.5	4.6
Women						
Germany	37.9	39.7	32.5	37.1	30.0	33.4
Denmark	19.4	37.3	16.9	28.6	14.7	28.6
Netherlands	63.8	68.3	63.2	64	61.6	60.4
Belgium	28.6	32.3	30.8	29.4	32.6	35.1
France	23.3	27.8	17.0	19.7	14.3	20.3
UK	43.7	45.3	15.8	23.7	14.0	26.0
Ireland	46.4	42.6	44.6	55.5	40.3	46.3
Italy	26.2	29.9	12.4	11.1	13.3	10.6
Greece	17.0	21.6	9.6	18.9	7.6	17.4
Spain	21.5	23.4	16.2	24.1	19.7	22.4
Portugal	12.5	25.6	11.7	24.8	10.8	25.2
Austria	<i>27.6</i>	<i>(25.9)</i>	29.3	31.5	30.6	27.5
Finland	<i>8.6</i>	<i>12.8</i>	9.1	15.7	8.0	17.3
Sweden	<i>15.9</i>	<i>22.0</i>	16.8	20.2	13.0	19.4

Notes: 1. Based upon self-assessed labour market status. 2. For Germany, Sweden and the UK, the presented numbers are from national surveys converted into the ECHP format. 3. The numbers in italics refer to the closest survey year that data is available: for Austria it is 1995, for Finland it is 1996, and for Sweden it is 1997. The numbers in parentheses indicate that data are missing for various ages within the age category. 4. The sample is weighted.

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**Table 2.3**

Working 1–34 h per week (%)

	1994		1998		2001	
	35-50	51-65	35-50	51-65	35-50	51-65
Men						
Germany	2.6	6.3	4.6	9.8	3.7	6.7
Denmark	3.1	6.7	2.7	8.6	3.4	5.8
Netherlands	7.3	14.0	10.0	17.5	11.6	17.0
Belgium	3.7	6.6	3.5	10.9	3.7	(8.7)
France	6.3	9.3	4.3	(6.8)	4.8	6.3
UK	3.5	10.5	3.7	9.6	4.3	7.7
Ireland	7.1	11.0	9.3	19.2	9.4	18.9
Italy	6.6	10.4	5.1	11.0	4.9	8.5
Greece	8.4	10.2	7.2	11.5	6.8	9.4
Spain	5.3	7.3	4.2	4.3	4.4	4.6
Portugal	3.8	9.4	1.9	7.6	1.6	7.1
Austria	<i>2.2</i>	<i>3.0</i>	2.8	(3.7)	2.6	7.2
Finland	<i>6.2</i>	<i>12.1</i>	6.9	12.8	4.5	12.1
Sweden	<i>3.5</i>	<i>10.8</i>	3.4	9.0	3.6	7.2
US	5.6	12.9	4.8	8.9	<i>4.1</i>	<i>8.4</i>
Women						
Germany	42.2	45.0	44.1	50.3	44.1	46.7
Denmark	30.4	50.6	33.1	40.8	30.5	46.1
Netherlands	75.1	75.5	77.9	75.4	76.0	79.1
Belgium	36.3	39.3	41.6	36.9	45.5	47.5
France	30.1	30.8	32.3	31.1	29.2	29.7
UK	50.2	58.5	48.1	54.2	44.7	56.5
Ireland	54.5	49.4	57.0	69.3	57.2	60.9
Italy	30.0	35.6	31.6	33.1	32.1	34.9
Greece	22.9	31.7	23.0	37.6	21.0	39.3
Spain	27.9	29.8	23.8	34.0	29.1	32.4
Portugal	16.4	32.2	16.4	32.8	15.5	32.9
Austria	<i>38.8</i>	<i>(32.9)</i>	41.0	35.6	41.0	35.5
Finland	<i>15.6</i>	<i>14.9</i>	16.7	19.5	16.5	21.0
Sweden	<i>33.5</i>	<i>38.3</i>	37.2	36.8	33.1	33.9
US	18.6	25.8	15.4	18.7	<i>14.5</i>	<i>19.8</i>

Notes: 1. For Germany, Sweden and the UK the presented numbers are from national surveys converted into the ECHP format. 2. The ECHP sample is weighted. 3. The US numbers are from the PSID. The sample is not weighted. 4. The numbers in italic refer to the closest survey year that data is available: for Austria it is 1995, for Finland 1996, for Sweden 1997, and for the US 2000. The numbers in parentheses indicate that data are missing for various ages within the age category.

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**Table 2.4**

Two-year transition rates 1994-2000 (%)

	FF	FP	FO	PF	PP	PO	OF	OP	OO
35-50 years old									
Austria	94.2	3.1	2.8	14.8	76.9	8.3	8.4	13.4	78.2
Finland	92.7	4.1	3.2	36.8	45.2	18.0	26.6	10.7	62.8
Denmark	92.8	4.3	2.9	21.3	69.4	9.3	24.8	13.9	61.3
Netherlands	91.8	5.8	2.3	9.6	83.8	6.7	5.8	16.7	77.5
Belgium	91.9	5.0	3.1	17.1	75.4	7.5	5.5	6.3	88.2
France	91.9	3.7	4.5	19.0	66.5	14.5	11.9	6.9	81.2
Ireland	90.1	5.6	4.3	16.5	68.2	15.3	8.3	17.3	74.4
Italy	92.2	3.6	4.2	23.8	66.0	10.1	6.7	4.6	88.7
Greece	88.8	5.1	6.0	32.0	52.3	15.6	11.9	5.6	82.5
Spain	89.2	3.8	7.0	37.3	40.3	22.4	13.0	4.8	82.2
Portugal	92.0	2.9	5.2	37.2	52.4	10.3	17.6	8.6	73.9
Germany	91.4	3.7	4.9	18.2	73.6	8.2	15.9	13.4	70.7
UK	91.4	4.7	3.9	18.2	72.2	9.6	10.5	12.9	76.6
US	94.6	3.5	1.8	52.2	37.4	10.2	19.6	11.8	68.5
51-65 years old									
Austria	71.2	2.2	26.6	13.9	56.8	29.4	0.9	1.2	97.9
Finland	75.7	7.4	17.0	14.2	49.1	36.7	2.0	2.3	95.7
Denmark	79.4	6.3	14.5	9.5	60.3	30.2	2.7	3.5	93.7
Netherlands	74.9	9.7	15.4	7.0	71.1	21.9	1.0	2.6	96.4
Belgium	73.9	6.0	20.2	9.7	54.8	35.5	0.4	0.9	98.7
France	74.1	4.4	21.5	11.2	51.0	37.7	1.2	0.9	97.9
Ireland	78.5	8.9	12.6	19.1	57.2	23.7	1.8	6.6	91.6
Italy	72.9	4.1	22.9	14.7	50.9	34.4	1.4	1.0	97.7
Greece	70.1	8.3	21.6	29.3	36.2	34.5	2.9	2.3	94.8
Spain	74.3	3.7	22.0	21.8	40.9	37.3	2.4	1.7	95.9
Portugal	76.6	7.7	15.7	20.2	49.6	30.2	3.9	4.4	91.6
Germany	74.5	4.8	20.7	10.4	61.1	28.4	1.7	2.4	95.9
UK	78.5	6.6	14.9	7.9	66.4	25.8	1.9	3.0	95.0
US	85.4	6.5	9.4	23.0	54.5	22.4	4.0	3.5	92.4

Notes: 1. For Germany, Sweden and the UK the presented numbers are from national surveys converted into the ECHP format. 2. The ECHP sample is weighted. 3. The US numbers are from the PSID. The sample is not weighted. 4. The numbers in italic refer to the closest survey year that data is available: for Austria it is 1995, for Finland 1996, for Sweden 1997, and for the US 2000. The numbers in parentheses indicate that data are missing for various ages within the age category.

## 2. GRADUAL RETIREMENT: PREFERENCES AND LIMITATIONS

Although part-time workers are not always in gradual retirement, this will still give an impression of how many older workers reduce their working hours toward the end of their career. The data used here were drawn from the European Community Household Panel, a panel dataset following individuals aged 16 and over from 1994 to 2001.<sup>7</sup>

Table 2.2 presents the shares of part-time workers among all workers (working either part-time or full-time) for men and women in two age categories, 35–50 and 51–65, and for the years 1994, 1998 and 2001. Part-time status is determined by the subjective question “Did you work full-time or part-time?” In almost all cases, part-time employment is more prevalent in the older age category than in the younger category, suggesting that workers reduce their work effort later in life. In many countries, the proportions of part-time workers decline over time, particularly for males. We therefore find no evidence that gradual retirement becomes increasingly prevalent over this time period. There is huge variation in the prevalence of part-time work across countries, for both sexes and in both age groups. In the Netherlands, part-time work among older men and among women in both age groups is much higher than in most other countries.

Table 2.3 defines part-time as working 1–34 h per week. Again, there is no clear time trend. In comparison to Table 2.2, the preference for reduced labour in the late working life is even more pronounced, particularly among men. Table 2.3 also contains the US, with data drawn from the Panel Study of Income Dynamics (PSID) (Since the PSID has no self-assessed part-time status, the US could not be included in Table 2.2). It shows that part-time work among women is less common in the US than in Europe for both age groups. The figures for men are comparable to those in Europe.

In the previous section, we discussed the remarkably large number of reverse retirement transitions in the US, from gradual retirement back to full-time work, or from full retirement back to full-time or part-time work. Although we cannot use Scott’s labour force status definitions for Europe to compare this type of mobility in Europe and the US, comparing ECHP and PSID as in Table 2.3 gives the possibility for a comparison of mobility based upon working hours only. Average 2-year transition rates for 1994–2000 between full-time work, part-time work and no work, the same classification as in Table 2.1, are presented in Table 2.4. The table reveals many differences across countries. The Netherlands stands out as the country where part-time work is most persistent, among both the younger and the older age group. In general, for the age group 51–65, reverse transition rates for the US are among the largest, although not completely out of line with the European transition rates. This suggests that reverse transitions also deserve more attention in many European countries. For example, it would be worthwhile to investigate the extent to which such transitions are anticipated, or are a reaction to an unexpectedly low replacement rate (cf. Maestas, 2007).

### 2.6 Gradual retirement in the Netherlands

Figures 2.1–2.3 illustrate the potential relevance of gradual retirement in the Netherlands. Figure 2.1 shows the development over the period 1987 until 2006 of employment rates for

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<sup>7</sup>See Peracchi (2002) for more information on ECHP.

## 2. GRADUAL RETIREMENT: PREFERENCES AND LIMITATIONS



**Figure 2.1.** Employment Rates. Source: Enquete Beroepsbevolking, Statistics Netherlands; 80,000 to 120,000 observations for each cross section. The variable is not available for the year 1991. Observations are weighted with cross sectional weights. The percentages represent the share of working population in the total of those working, unemployed or not belonging to the labour force.

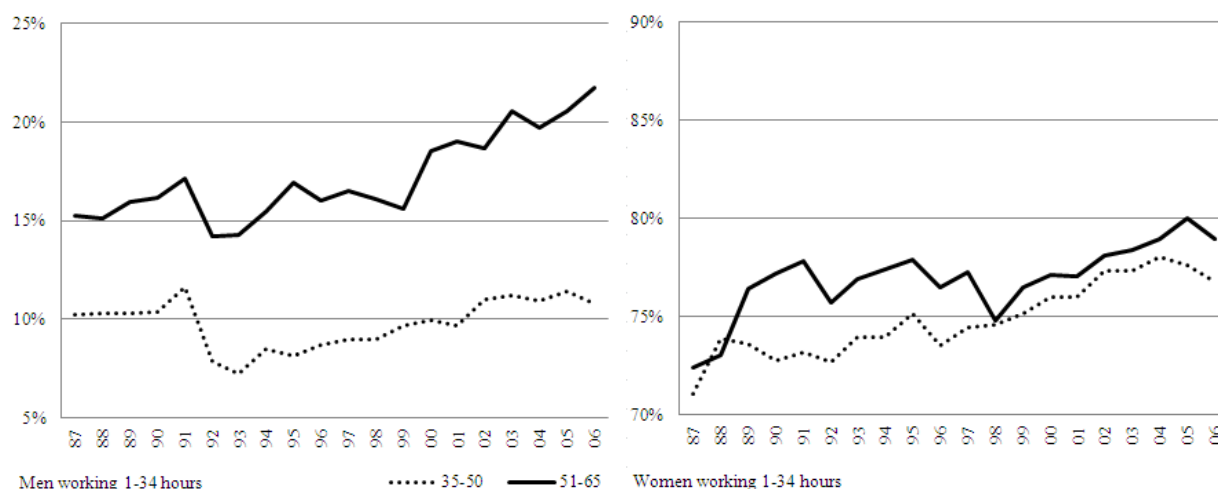
men and women, for the age groups 35–50 and 51–65 (where only people who work 12 h per week or more are counted as employed). The employment rate among prime age men has been rather stable at around 90%. The employment rate of the older part of the male labour force has increased substantially around the turn of the century and has stabilized at about 60% since then. For prime age women, employment rates have increased substantially until about 2001 and seem to have stabilized since, while the employment rate among women in the age group 51–65 continued to increase. Both figures suggest that a policy of increasing employment has more promise for the older part of the labour force than for the prime age groups.

Figure 2.2 presents the fraction of part-time workers (working 1–34 hours) among all workers. For men aged 51–65, this percentage has increased a few percentage points around 2000, whereas it has remained stable for men aged 35–50. The larger rates for older men suggest that a substantial number of men reduce their hours when approaching retirement age. For women, part-time work is hardly more common among the older than among the younger ages. The increasing rates among younger women may be related to the increase in participation (Figure 2.1) – much of this is in the form of part-time work.

It is interesting to compare Figure 2.2 with Figure 2.3, presenting the percentage that would want to work part-time. Particularly for men aged 51–65, this percentage has increased substantially over the past decade and exceeds by far the percentage of men who actually work 1–34 h. This suggests that many older men would like to reduce their work hours and take some form of gradual retirement, but for some reason are not able to do this.

This discussion makes clear that both limitations imposed by employers or institutions and preferences of the workers are important determinants of gradual retirement. In the remainder of this section, we consider both.

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**Figure 2.2.** Employees working 1–34 h. Source: Enquete Beroepsbevolking, Statistics Netherlands; about 60,000 observations for each cross section. Observations are weighted with cross sectional weights. The percentages represent the share of those working 1–34 h in those working any number of hours.



**Figure 2.3.** Employees desiring to work 1–34 h. Source: Enquete Beroepsbevolking, Statistics Netherlands; 5,000 to 9,000 observations for each cross section. Observations are weighted with cross sectional weights. The variable is not available for 2000 and before 1991. The percentages represent the share of those who desire to work 1–34 h in those who desire to work any number of hours.

## 2. GRADUAL RETIREMENT: PREFERENCES AND LIMITATIONS

**Table 2.5**

Estimation results

	LOGIT		OLS	
	Access to phased retirement		Age of phased retirement	
	Coefficient	t-value	Coefficient	t-value
Men	−0.13	−0.60	0.47	1.33
Children 1+	0.20	1.00	0.90	2.26
Partner	0.14	0.63	0.40	0.81
Age 35-44	−0.18	−0.73	0.93	1.85
Age 45-54	0.16	0.68	1.72	3.41
Age 55+	−0.07	−0.25	1.99	3.49
Education mid	0.02	0.07	0.50	0.96
Education high	0.19	0.77	0.59	1.01
Income mid	0.37	1.30	−0.02	−0.03
Income high	0.48	1.33	−0.41	−0.61
Region west	−0.35	−1.27	−1.01	−2.32
Region north	−0.12	−0.36	−0.54	−0.87
Region east	−0.08	−0.28	−0.38	−0.91
Region south	0.00	0.01	−1.18	−2.40
Sector comm. service	−0.28	−1.20	0.19	0.39
Sector publ. service	0.73	3.10	−0.12	−0.25
Intercept	−0.68	−1.44	58.57	57.68

Notes: 1. Logit estimates: Employees ages 25–65, CentER panel, 815 observations. Dependent variable: dummy for perceived access to phased retirement with current employer. 2. OLS estimates: Employees ages 25–65, CentER panel, respondents with access to phased retirement at current employer; 393 observations. Dependent variable: perceived age at which phased retirement can start.

### 2.6.1 Legal issues

Ceelen (2007) considers legal issues that restrict access to gradual retirement. The general conclusion of his analysis: although no major legal obstacles seem to exist, some fine-tuning is still required, particularly concerning taxation. Specific issues arise if gradual retirement is combined with another tax favoured arrangement, the so-called life-course scheme. Ceelen recommended more transparency of the tax treatment in such cases. Other issues arise with working after age 65. For example, not all pension funds allow for accumulating pension entitlements after age 65. Moreover, the obligation to pay wages for two years if the employee becomes ill may be an impediment for employers. Thus there is some scope for specific policies for workers aged 65 and older.

### 2.6.2 Employer attitudes

In March 2007, we fielded a survey focusing on opportunities provided by and restrictions imposed on phased retirement. Employees older than 25 years of age in the CentERpanel (a representative panel of the Dutch adult population, see [www.centerdata.nl](http://www.centerdata.nl)) were asked how they perceived the possibilities for phased retirement at their current employer. The sample has 815 observations. The first question in the module on phased retirement was as follows:

## 2. GRADUAL RETIREMENT: PREFERENCES AND LIMITATIONS

**Table 2.6**

Reasons for non-access to phased retirement - Frequency distributions

	Does not apply	Applies perhaps	Probably applies	Definitely applies	Most important reason
R1	38.9	15.1	15.3	21.8	8.7
R2	46.6	13.7	17.6	12.6	9.2
R3	38.4	24.1	24.7	7.4	5.1
R4	31.9	17.3	21.5	18.6	10.5
R5	54.2	18.5	17.1	6.7	3.3
R6	35.8	20.4	25.8	12.5	5.2

Notes: Employees ages 25–65, CentER panel, respondents without access to phased retirement at current employer; 423 observations Rows: Reasons for not offering gradual retirement: R1: Part-time work is not attractive for the type of work I do R2: My employer does not offer any part-time jobs R3: My pension fund does not allow for a partial pension R4: My employer prefers that people like me keep working full-time until normal retirement age R5: My employer prefers that people like me retire completely as early as possible R6: My employer thinks the cost of part-time workers relative to full-time workers is too high.

“Does your employer offer you the possibility of part-time retirement? (Part-time retirement means that you retire part of your working week but keep working the other part – for example, from age 62 until age 65.)”

Almost half of the respondents (47.3%) of the sample answered affirmatively. This is much higher than in van Soest et al. (2006), who used data from 2004 and also included retired former employees and found that 34.2% responded affirmatively. The difference cannot be explained solely by the lower rate among retirees (who were asked about their last job as an employee) and suggests that perceived access to phased retirement has increased, which corresponds to the fact that large pension funds have created transparent opportunities for partial pensions.

The left hand panel of Table 2.5 presents the estimates of a logit model explaining the dummy variable that has value 1 for respondents who think they have access to phased retirement, and 0 for those who do not think they have access. A positive coefficient on an explanatory variable thus means that an increase in this variable makes access to phased retirement more likely (although, since we only measure the employee’s perception, it might also mean that the respondent has different information). Phased retirement opportunities are significantly more common in the public sector than in manufacturing or commercial services. The difference in the access probability for an average worker in the public sector and the manufacturing sector is about 18% points, keeping other variables constant. Other variables are not significant, although the income variables are jointly significant at the 10% level, suggesting that access to phased retirement is more common among the higher income groups.<sup>8</sup>

Employees who answered the question on access to phased retirement affirmatively then got a follow-up question on the earliest age at which they thought they could reduce their hours of work. The distribution of the answers is concentrated at ages 60 and 62, with about

<sup>8</sup>Other job characteristics that might play a role are occupation (level) and firm size, but these are not available in the current data set.



## 2. GRADUAL RETIREMENT: PREFERENCES AND LIMITATIONS

**Table 2.7**  
Ordered logits: Reasons for non-access to phased retirement

	R1		R2		R3		R4		R5		R6	
	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value
Men	0.87	3.36	0.28	0.98	0.27	1.06	0.74	2.83	0.54	1.95	0.57	2.29
Children 1+	-0.18	-0.71	-0.04	-0.16	0.39	1.48	0.00	0.01	0.18	0.63	0.09	0.33
Partner	0.54	1.98	0.09	0.35	-0.03	-0.11	-0.13	-0.47	-0.16	-0.56	-0.26	-1.01
Age 35Ů44	-0.14	-0.45	-0.53	-1.71	0.13	0.42	-0.32	-1.09	-0.12	-0.39	-0.37	-1.23
Age 45Ů54	0.19	0.63	-0.19	-0.59	0.09	0.32	-0.24	-0.80	-0.17	-0.53	-0.07	-0.24
Age 55+	-0.52	-1.34	-0.95	-2.58	0.10	0.25	-0.18	-0.50	-0.21	-0.56	-0.29	-0.81
Education mid	0.64	2.25	0.57	2.10	0.75	2.59	-0.04	-0.16	0.54	1.85	0.09	0.32
Education high	-0.07	-0.22	-0.47	-1.56	0.65	1.88	-0.40	-1.46	0.06	0.17	0.22	0.66
Income mid	0.07	0.20	0.71	1.90	0.49	1.47	0.79	2.47	-0.29	-0.75	0.53	1.55
Income high	0.98	2.20	0.98	2.14	0.68	1.47	1.30	3.15	-0.05	-0.11	0.13	0.28
Region west	-0.30	-0.92	-0.42	-1.23	0.39	1.24	0.05	0.15	0.24	0.70	-0.20	-0.61
Region north	0.58	1.37	0.06	0.15	0.37	1.00	0.10	0.21	0.99	2.23	-0.16	-0.36
Region east	-0.22	-0.60	-0.29	-0.76	0.32	0.95	-0.05	-0.13	0.39	1.08	-0.14	-0.40
Region south	-0.43	-1.24	-0.15	-0.41	0.58	1.81	0.17	0.49	0.49	1.38	-0.10	-0.30
Sector comm.	0.05	0.17	-0.59	-1.98	0.20	0.71	-0.29	-1.08	-0.36	-1.26	-0.32	-1.10
Sector publ.	-0.39	-1.20	-1.02	-3.08	-0.28	-0.84	-0.94	-2.87	-0.46	-1.42	-0.70	-2.26
Threshold 1	0.49		-0.31		1.28		-0.45		0.56			-0.66
Threshold 2	1.19		0.33		2.33		0.43		1.43			0.24
Threshold 3	1.96		1.31		3.85		1.50		2.71			1.61
Threshold 4	3.62		2.40		4.82		2.89		3.92			3.03

Notes: Employees ages 25–65, CentER panel, respondents without access to phased retirement; 415 observations. Dependent variable: importance of argument why employer does not give access to phased retirement. Reasons R1–R6 are explained in Table 2.6.

## 2. GRADUAL RETIREMENT: PREFERENCES AND LIMITATIONS

30% and 35% of the (393) observations, respectively. The overall mean is 60.3 years of age. The right hand panel of Table 2.5 presents the results of a linear regression explaining this earliest age of phased retirement from background variables (not correcting for selective access). Several variables are significant. The expected age rises with the presence of children, which may reflect a selection effect – respondents with children might have chosen different types of jobs. The earliest phased retirement age also rises with the age of the respondent, suggesting that younger cohorts are less optimistic about early phased retirement. The highest age of phased retirement is reported in the three big cities. Finally, somewhat surprisingly, no differences across sectors were found. In general, it seems difficult to interpret these results, perhaps due to the selective nature of access to phased retirement or because variables proxy something else.

The respondents who reported not to have access to phased retirement were asked why they think their employer does not offer such opportunities. Each respondent was asked to assess the importance of six potential reasons, presented in Table 2.6, on a five-point scale (from 1: “does not apply” to 5: “the decisive argument”); Table 2.6 shows the frequency distribution of these ratings. Reasons 4 (employer wants me to continue working full time) and 1 (part-time not attractive for my kind of work) appear to be the most important ones. The fact that reason 4 is rated more important than reasons 5 and 6 seems to confirm that older workers are seen as valuable, with useful experience and high productivity, but some words of caution are necessary: this is the employees’ perception of their employer’s considerations, and not directly the view of the employers.

Table 2.7 presents ordered logit estimates explaining the rating of each of the six reasons separately. The difference between men and women is largest for the first reason: part-time work is not attractive for the type of work typically done by men. This seems in accordance with the fact that women often choose occupations where part-time work is more common and generally accepted. Men are also much more often in jobs where (at least in the worker’s perception) employers want to keep them full-time until normal retirement age (reason 4).

The education patterns show that workers with an intermediate level of education differ considerably in their answers, while workers with high and low levels of education are more similar. Workers with intermediate education are often skilled workers with vocational training in professions where part-time work is not common (reason 1). They also often think reason 3 is important: restrictions in the rules imposed by their pension funds. Perhaps this is because they often participate in (smaller) pension funds, where rules for phased retirement are not as generous or transparent as for large pension funds. For high-income workers, the argument that employers want to keep their workers full-time is relatively important (reason 4), but they also attach significantly more weight to reasons 1 and 3, which both refer to the nature of their work.

The only significant difference across regions is that workers in the northern provinces more often have the impression that their employer wants to consign them to early retirement as soon as possible. There are many significant differences across the three sectors. Several reasons are much less important in the public sector than in the manufacturing industry. The most important reason is that employers simply do not offer part-time jobs (reason 2) – part-time work is much more common in the public sector than elsewhere.

## 2. GRADUAL RETIREMENT: PREFERENCES AND LIMITATIONS

### 2.6.3 Preferences for gradual retirement and labour supply

van Soest et al. (2006) used a stated-preference technique to estimate gradual retirement preferences of the Dutch. They presented hypothetical retirement scenarios to a sample of workers and former workers aged 25 and over, and asked them to rate each of these scenarios on a scale from one to ten. An example of such a scenario is as follows:

Until 65	From 65 until 70	70 and over
Working 38 h per week.	Working 23 h per week, after-tax income is 100% of earnings at age 65.	Not working, net pension income is 90% of after-tax earnings at age 65.

This scenario has gradual retirement from age 65 until age 70. An introductory text asked the respondent to assume that the employer fully cooperates, so that the scenario refers to phased rather than partial retirement. The replacement rates during phased retirement and after full retirement are randomized. Respondents rated eight scenarios, with and without gradual retirement and with varying replacement rates and (gradual) retirement ages.

The differences between the average ratings give a first impression of people's preferences. For example, the scenario presented above has an average rating of 4.0, compared to 4.8 for the benchmark scenario – full-time work until age 65 and complete retirement thereafter with a 70% replacement rate. This suggests that people on average dislike working after age 65, even part-time, in spite of the compensation in the form of a higher income after age 65. Higher average ratings are given for scenarios of gradual retirement centering at age 65 (gradual retirement at age 63; full retirement at age 67).

van Soest et al. (2006) used these ratings to estimate an inter-temporal model explaining retirement choices. Table 2.8 reproduces some of their results, giving the average probabilities that a hypothetical scenario is rated higher than the benchmark (no gradual retirement; full retirement at age 65 with replacement rate 70%). The table shows that hardly anyone would be interested in working full-time until age 70, even if the replacement rate were 100%. Early retirement, on the other hand, is much more attractive, particularly for a high (and actuarially unfair) replacement rate of 60%. Phased retirement can be made attractive with a high replacement rate after full retirement.

van Soest et al. (2006) also used their model to simulate choices between early retirement, late retirement, and a scenario involving phased retirement, with hours equal to 60% of pre-retirement working hours during the phased retirement period. They found that 67% would prefer early retirement, and 33% would prefer late retirement if no partial retirement option were available. With partial retirement as a third option, their simulations suggested that 43% would have chosen partial retirement, 38% would have chosen early retirement, and 19% would have chosen late retirement. Total labour supply would increase substantially. Though this outcome depends on many factors (such as the generosity of the hypothetical gradual retirement scheme), it does illustrate the potential of gradual retirement as a tool to increase the labour supply of older people.

Bruinshoofd and Grob (2005) also found that the Dutch are willing to work part-time beyond the normal retirement age (65 years). They analyse a survey question on whether people are willing to work after age 65, without losing their old-age state pension (AOW). While only 2% of the respondents answer “yes, full-time,” 32% say “yes, part-time.” The

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**Table 2.8**

Simulated choice probabilities: Alternatives to benchmark

Scenario	Partial retirement		Full retirement		Probability
	Age	% Income	Age	% Income	
1: Postponed retirement	-		70	90	0.04
2: Postponed retirement	-		70	100	0.13
3: Early retirement			62	60	68.21
4: Early retirement			62	50	11.32
5: Partial retirement	63	85	67	70	66.34
6: Partial retirement	63	100	67	70	77.79
7: Partial retirement	63	85	67	80	91.30
8: Late partial retirement	65	90	70	90	20.12
9: Late partial retirement	65	100	70	100	47.16
10: Early partial retirement	60	75	65	60	69.17

Source: van Soest et al. (2006, Table 6). Note: “Probability” is the probability that the given scenario is preferred to the benchmark, which is full retirement at age 65 for a 70% net pension. Simulated probabilities assume no optimization error.

others answer “no” (57%) or “do not know” (9%). This question does not specify the financial compensation for working longer, but other results in the same study imply that retirement decisions are quite sensitive to financial incentives.

## 2.7 Conclusions

While the descriptive evidence of the prevalence, nature and duration of gradual retirement is abundant for the US, gradual retirement is much less studied in Europe. Part-time work is generally more common among older than among younger workers, but there is substantial variation across countries that remains to be analysed and explained. There is some evidence that financial incentives stimulating gradual retirement will work, but there is scope for incorporating gradual retirement in more rigorous quantitative studies based upon structural models on retirement decisions, like, e.g., Stock and Wise (1990); Gustman and Steinmeier (1986b); Blau (1994); or Rust and Phelan (1997). The quantitative impact of policy measures thus remains largely to be determined. Whether they give the same results in different countries also remains to be seen, given the many differences in the institutional settings (e.g. DC and DB pensions, health insurance, housing markets, borrowing constraints, etc.). Data on stated preferences can be a useful tool to disentangle workers’ preferences from limitations imposed by employers and institutions. In addition, richer data on actual opportunities and choices are becoming available, for example in the form of register data from the Dutch pension funds.

In Europe and the US, gradual retirement is generally seen as an opportunity to keep older workers longer in the labour market. The few studies that make the quantitative trade-off of the negative and positive labour supply effects unambiguously conclude that the positive effects dominate: creating more opportunities for gradual retirement can lead to an increase in total labour supply. This makes facilitating gradual retirement attractive from a public policy point of view. The evidence of the effect of gradual retirement on productivity

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is scarce, but the qualitative conclusions point in the same direction: the older workers who are kept in the labour force are typically well motivated, highly skilled and productive. Gradual retirement can also prevent labour market exit through alternative routes, i.e. unemployment and disability, which is particularly relevant in the Dutch context (see, e.g., van Vuren and van Vuuren, 2007), particularly if (very) early retirement arrangements are abolished. For workers, the main advantage is a smooth transition to the next stage of life, and an escape from the choice between two inferior options: continuing in a stressful career job with the risk of work disability or full retirement with its negative financial and social consequences. For employers, there seem to be advantages and disadvantages, and not all employers are as yet convinced that gradual retirement should be stimulated. However employers seem to realize increasingly that older workers offer valuable experience, can guarantee continuity, and can contribute to the corporate spirit. These advantages may outweigh such potential disadvantages as fixed costs of work and problems in organizing part-time job schedules.

Still, take-up of gradual retirement is rather low in most European countries. Where the mobility in the US labour market accommodates older workers who want to leave their career job to take up a bridge job as a form of partial retirement, this is much less the case in the Netherlands and other European countries. Here phased retirement seems the best option, creating opportunities for part-time work without changing employer.

In addition to (perceived) disadvantages on the employers' side, institutional restrictions imposed by the government or providers of pension plans seem to play a role. Macroeconomic circumstances also matter – gradual retirement is less accepted in times of recession – and policies that jointly consider several exit routes (early retirement, disability, unemployment) are probably preferable. There is room for less stringent rules on combining work with partial-pension receipt, and for more transparency of these rules. In addition, the government can stimulate gradual retirement through transparent tax measures that make gradual retirement more attractive for workers and less expensive for employers. The existing evidence suggests that in the Netherlands, tax favoured arrangements will work – the decision to take up gradual retirement or not is sensitive to financial incentives, like the decision to apply for disability insurance (van Vuren and van Vuuren, 2007) or the decision to retire (Kapteyn and de Vos, 1998). In particular, it seems important to ensure that staying in the labour market as a part-time worker is rewarded in the form of a higher old age pension.

### 3 Implications of full and partial retirement for replacement rates in a defined benefit system

We use the actual rules and formulas of an occupational pension fund, the state pension fund and the tax system in the Netherlands to calculate net replacement rates at each age from 60 to 70 in full and partial retirement scenarios. We then vary the parameters of the pension formulas to study the sensitivity of the replacement rates. We also analyze the implications of late full retirement and partial retirement for the occupational and state pension entitlements. We pay particular attention to the retirement scenarios that are relevant for the current policy measures, aimed at making people work longer. We find that in the full retirement scenarios the replacement rates depend substantially on the underlying parameters of the pension system and on worker characteristics. In the partial retirement scenarios these changes are much less substantial. We also find that partial retirement results in a much smoother income path and encourages employees to defer their pension claims beyond age 65.

#### 3.1 Introduction

Labor force participation and labor supply of older workers is at the top of the policy agenda in many OECD countries. Early retirement programmes and other exit routes that lead to early withdrawal from the labor market imply a burden for the macro-economy, magnified by the aging of the population (see, for example, Latulippe and Turner, 2000 and Belloni et al., 2006). In many countries, the debate focuses not only on abolishing very generous early retirement schemes, but more generally on increasing flexibility and allowing individuals to choose an optimal labor market trajectory among a set of actuarially fair options. This implies removing mandatory retirement, getting rid of impediments for working after a given standard retirement age such as issues with health or disability insurance, and removing obstacles for partial retirement (also called gradual or phased retirement), such as financial disincentives in the pension system or the tax rules. Since the literature suggests that financial incentives play a large role for retirement decisions (see, for example, Gruber and Wise, 2004), this may have important consequences for labor force participation and hours worked by older age groups.

Partial retirement in particular has the potential to improve the lifetime utility of older workers by smoothing the transition for a working life to a life with very different activities, while at the same time increasing labor supply and the sustainability of the pension system if it raises total hours worked. Several studies have analyzed the impediments for partial retirement in the United States (Chen and Scott, 2003; Brown and Schieber, 2003; Hurd, 1996; Hutchens, 2010). In Europe, several studies have compared incidence of partial retirement across countries and have analyzed specific programmes to stimulate partial retirement in

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various countries (see, for example, Delsen and Reday-Mulvey, 1996, Reday-Mulvey, 2000, Wadensjö, 2006).

In this paper we analyze the financial incentives and disincentives for early and late full and partial retirement for Dutch employees entitled to an occupational pension from the largest pension fund in the Netherlands. After substantial reforms in the past 20 years, this pension fund now aims at maximum retirement flexibility with actuarially fair trade offs: the employee can choose how much to work at an older age, but pays a fair price for retiring early or working fewer hours and is rewarded for working longer. While the occupational pension system is actuarially fair, we analyze the links to the state pension system and several features of the tax, benefits, and income or employment status related subsidies that break the actuarial fairness from the point of view of the employee considering net replacement rates. Our main goal is therefore to show to which extent a flexible occupational pension system that seems to put the incentives right *ex ante* can still have actuarially unfair features reducing labor force participation and labor supply due to taxes and benefits that are inherently linked to the occupational pension.

In the Netherlands, all retirees who never lived abroad receive the full state pension and former employees also receive an occupational pension of the Defined Benefit type (Alessie and Kapteyn, 2001). This fairly homogeneous pension system allows a systematic analysis of retirement income across a large population of retirees with otherwise heterogeneous characteristics. We consider a hypothetical employee with given earnings level, entitled to a full state pension, and participating in the biggest occupational pension scheme in the Netherlands. We calculate this worker's future pension entitlements using the actual rules and formulas of these schemes. We also calculate net work income and state and occupational pension entitlements using the currently effective Dutch income tax rules. These amounts are used to calculate the net replacement rate which measures the financial well-being of the employee in retirement and the effectiveness of the pension system to replace earnings. We then determine the sensitivity of the net replacement rate to changes in the parameters of the underlying pension system and the labor market characteristics of the employee to analyze how the financial well-being of the retiree is affected by the changes in these parameters.

We compute net pension entitlements and replacement rates in early and late retirement scenarios and differentiate between full and partial retirement. Early retirement schemes were introduced in the 1980s and are still common in the Netherlands (Euwals et al., 2010). We consider cases of early receipt of an occupational pension, with pension amounts actuarially reduced for early receipt. Later retirement is expected to become more prevalent with the increase in the state pension age and the phasing out of early retirement incentives. We consider cases of delayed receipt of an occupational pension, with pension amounts adjusted in an actuarially fair manner. We also consider delaying the state pension because the Dutch government is considering to allow delaying part or the full amount of the state pension beyond age 65, for about a six percent increase of the state pension for each year of delay. We analyze the financial impact of delaying the state pension for the beneficiary, and on the aggregate level for the public finances.

Besides early or late full retirement, we consider partial retirement at varying duration. Partial retirement is relevant for several reasons. First, the plans to raise the state pension

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age to 67 aim to make people work longer, while currently many employees in the Netherlands are observed to retire much earlier than age 65 (OECD, 2006). Partial retirement may help to keep people employed between the effective and statutory ages of retirement and may decrease the number of years full pension rights are claimed. Second, elderly Dutch employees express substantial interest in working part-time before retiring fully but appear to be restricted by labor market rigidities (Kantarci and van Soest, 2008). Third, partial retirement provides a smoother transition into full retirement, in terms of income but mainly also in terms of daily activities, social contacts, etc. Income smoothing can be achieved because employees can supplement their retirement income with part-time earnings. Partial retirement may even be beneficial to health, since working part-time instead of not at all may help to limit the loss of cognitive skills, which is recently shown to arise with full retirement (Rohwedder and Willis, 2010). In reference to partial retirement, we analyze cases where employees claim part of the occupational and state pensions they are entitled to and defer the other part until their full retirement age. The partial retirement scenarios we consider may be attractive alternatives to the traditional full retirement scenarios.

Studies particularly close in spirit to our study are the following. Forman and Scahill (2003, 2004) calculate pension rights in full and partial retirement scenarios in a final average pay defined benefit system. Munzenmaier and Paciero (2002) and Brown et al. (2005) calculate net replacement rates in full and partial retirement scenarios using observed pension entitlements in defined contribution and defined benefit plans. Fouarge and Huynen (2005) and Euwals et al. (2010) calculate gross replacement rates for full retirement at early and normal retirement ages using observed data in the Netherlands. However, these studies do not calculate pension rights or replacement rates beyond the statutory retirement age and provide limited information on how the pension rights or the replacement rates change with the underlying rules of the pension system and with worker characteristics. The full and partial retirement scenarios are also often simplified. As a result, in the given pension systems in these studies, it is difficult to identify an employee's opportunity set and financial well-being in different retirement scenarios.

The main results of this paper are the following. Analysis of the occupational pension shows that partial retirement around age 65 provides an actuarially neutral alternative to full retirement at age 65. Analysis of the state pension shows that the financial gain for the individual when the state pension is deferred beyond age 65 is rather limited. The principal results of the replacement rate analysis are the following. First, partial retirement instead of full retirement results in a much smoother income path before age 65 and encourages employees to defer their pension rights beyond age 65. Second, replacement rates differ substantially across employees with different earnings levels in the cases of early and late full retirement, and this difference is much less substantial in the case of partial retirement. The replacement rates also change substantially with respect to service length, domestic situation, and the occupational pension accrual rate. Third, the government's current plan of increasing the retirement age to 67 allows for a reduction of about 25% in the current accrual rate of occupational pension rights while the financial well-being of a retiree at age 67 remains the same as that of a retiree at age 65 if the retirement age is not increased.

The remainder of the paper is structured as follows. Section 3.2 introduces the pension system and Section 3.3 introduces the tax system in the Netherlands. Section 3.4 analyzes



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the occupational pension income and Section 3.5 analyzes the state pension income. Section 3.6 calculates net replacement rates and analyzes them for changing parameters of the pension system. Section 3.7 concludes.

## 3.2 The Dutch pension system

The retirement income in the Netherlands stands on three pillars. The first pillar is the state pension, the second pillar is the occupational pension, and the third pillar is private pension savings. Participation in the first two pillars is mandatory. We do not consider the third pillar because its share in retirement income is much smaller but also considerably more heterogeneous across individuals than the other two main pillars (Alessie et al., 1997; Alessie and Kapteyn, 2001). Our analysis is therefore based upon the first two pillars. In Sections 3.2.1 and 3.2.2 below, we describe the occupational and state pension schemes and how they are implemented in selected retirement scenarios. Table 3.4 shows one such retirement scenario. In the note to the table we specify the parameters of the occupational pension scheme, the state pension scheme, and the labor market behavior of a hypothetical employee. In the table we present a time line that shows the ages at which the employee is working or retired. Below the time line we show, for the corresponding ages, the amounts of occupational and state pensions that the employee is entitled to, as well as the amount of earnings.<sup>9</sup> The amounts presented in the table depend, among others, on the parameters shown in the note to the table. In the table we also present the amounts of the tax and tax credits and the calculation of the net replacement rates, explained in later sections.

In our exposition below, all pension and tax rules and parameter values are for year 2010 and assumed to remain unchanged thereafter. Parameter values of past years are irrelevant to the current analysis. Certain pension and tax rules are different for cohorts born before 1950s. We assume the cohort is younger. None of the parameters of the analysis depends on gender. For convenience, we refer the employee as ‘he’ unless we need to be specific about gender.

### 3.2.1 An occupational pension scheme

The majority of the occupational pensions in the Netherlands are of the defined benefit type. We base our analysis on the defined benefit scheme of the Algemeen Burgerlijk Pensioenfonds (ABP), the biggest pension fund in the Netherlands.<sup>10</sup> ABP is an industry-wide pension fund covering employees in the government and education sectors. The scheme is funded so that the pensions are financed from the premiums of the participants paid in the past and from the returns on the investment of these premiums. These premiums, for a period of one year,

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<sup>9</sup>In the tables, we abbreviate occupational pension as OP, state pension as SP and health care insurance as HI.

<sup>10</sup>Besides the prevalence of defined benefit schemes in the Netherlands, our choice of the defined benefit system for the analysis of retirement income is not arbitrary but one of a necessity because in the alternative defined contribution system the pension entitlements vary across individuals with respect to their idiosyncratic saving patterns which makes it difficult to analyze retirement income in full and partial retirement scenarios at different ages that are representative for one population or another.

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**Table 3.1**

Occupational pension premiums

Premium type	Premium rate (%)		State pension offset (€)
	Employer	Employee	
OP OP/NP	14.910	6.390	10,500
OP ANW	0.075	0.225	10,500
OP AAOP	0.300	0.100	18,200
OP VUT/FPU	1.450	2.250	-

Source: Stichting Pensioenfonds ABP (2010a). Notes: Employees pay premiums to ABP for four types of benefits: The old age and surviving dependants' pension (OP/NP), surviving dependants' pension insurance (ANW), disability pension (AAOP) and flexible early retirement pension (VUT/FPU). The premium rate of the disability pension differs across the government sectors but the rate shown in the table applies to the majority of these sectors. The presented premium rates are effective from August 1, 2010 until December 31, 2010.

are calculated according to the formula:

$$FTE_t * PR_i * (PI_t - SPO_{t,i}). \quad (3.1)$$

The full-time equivalent (FTE) is the ratio of the actual number of hours of paid work to the number of working hours in a full-time job. In the equation, FTE determines the fraction of the premium paid in the corresponding work year at age  $t$ . The premium rate (PR) is the contribution rate. It is shared between employee and employer and specific to the type of the premium ( $i$ ), as shown in Table 3.1. Pensionable income (PI) is the amount of annual gross income on a full-time basis, including holiday allowance and end-of-year bonus.<sup>11</sup> For a part-time worker, it is obtained by dividing the actual earnings with the FTE of the part-time worker. The state pension offset (SPO) is determined by the pension fund but it closely follows the state pension benefit which is equal to the net minimum wage. It is specific to the type of the premium ( $i$ ) as shown in Table 3.1. Employees pay premiums for their occupational pension over the so called premium base ( $PI_t - SPO_i$ ). PI is reduced by the SPO because employees also pay premiums for their state pension, although the premium base for the state pension premiums is not the SPO; see Section 3.2.2.

Unlike in a defined contribution plan, the participant does not accumulate pension rights according to the premiums he pays and the returns generated on these premiums, but according to the formula:

$$PA_{op_{25-64}}^d = \sum_{t=25}^{64} FTE_t * AR_{op_t} * (PI_t - SPO_t). \quad (3.2)$$

The formula shows the accumulation of pension rights during an assumed period from age 25 to 64. The accumulated pension rights are paid as an annuity as of age 65 when the

<sup>11</sup>In fact, the annual gross income will slightly differ from the pensionable income. This is because employers increase the annual gross income by a certain percentage, but up to a maximum amount of €791.85, to compensate the employee for a certain type of transfer fee. To prevent this increase in gross income to increase the pension premiums employees pay, employers reduce the gross income by the amount with which it is raised when calculating the pensionable income. Our calculation of the pensionable income accounts for this adjustment. In particular, we assume below that the employee earns an annual gross income of €30,000 which is adjusted to a pensionable income of €29,441.

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beneficiary retires. FTE is as defined above. The accrual rate ( $AR_{op}$ ) is the rate at which the pension rights build up. The current rate is 2.05% and we assume that it does not change throughout the period.<sup>12</sup> Pension rights accrue over the premium base ( $PI_t - SPO_t$ ). In our analysis we assume that gross income is constant throughout the period when pension rights are being accumulated. This is a stylized case since in reality the age profile of gross income is usually not flat over the life cycle. SPO is roughly equal to the net minimum wage and its current level is €10,500.

The presented scheme is an average salary scheme because the salary of each year contributes to the eventual amount of the pension annuity in Equation (3.2). There are three specific issues regarding the pension annuity in Equation (3.2) that need to be mentioned. First, the pension annuity depends on the domestic situation (d). If the participant is not single when he first claims his pension rights, Equation (3.2) gives his actual pension amount, and the participant's spouse is entitled to a survivor pension when the participant dies. If the participant is single when he first claims, the pension amount in Equation (3.2) is increased by 16.8%.<sup>13</sup> Second, the accrual of pension rights in Equation (3.2) is increased by a supplementary amount of €40.50 in a year if the employee earns in that year a gross income that is less than €28,031, a threshold determined by ABP. The threshold income and the amount of the supplementary pension rights depend on the full-time equivalent of the employee (Stichting Pensioenfonds ABP, 2010b). Our calculations account for this supplement. Third, every year ABP aims to increase the pension annuity in accordance with the average increase in wages in the government and education sectors. The increase in the pension annuity can be the same, lower, or higher than the increase in the average wage, depending on the financial situation of the pension fund. This is called conditional indexation. For example, on January 1, 2008, ABP has increased the pension rights by 2.05%, according to the average wage increase in that year, but also by an additional 1.96%, to compensate for the lack of increase in previous years, since its financial situation improved in 2008. Table 3.2 documents the increases in pension rights, average wages and general prices from 2005 until 2009. In our analysis we assume no increase in wages, and hence no indexation. This implies that our analysis can be interpreted as an analysis of real wages under the assumptions of full indexation and equality of wage and price inflation.

Table 3.4 demonstrates a retirement scenario where we calculate the prospective pension entitlement of a hypothetical employee who starts to participate in the described pension scheme today at age 25 and works full-time (staying in the same pension scheme) without interruptions until full retirement at age 65. His PI is €30,000, which is roughly the average gross income in the Netherlands. The employee builds up €388 every year which amounts to a gross occupational pension annuity of €15,531 at age 65, as shown in the table. We denote this annuity as  $PA_{op25-64}^d$ . The lower panel of the table shows the premiums paid to the pension fund according to Equation (3.1), which amount to €1,927 per year.

Table 3.5 demonstrates a second retirement scenario where the hypothetical employee

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<sup>12</sup>In fact, the accrual rate changed only with specific policy changes – it increased from 1.75% to 2.05% when ABP changed the final salary scheme to the career average scheme in 2004. Moreover, it depends on the state pension offset SPO. If SPO is increased (due to, for example, an increase in the minimum wage), the accrual rate must be reduced. For simplicity, we do not consider such changes.

<sup>13</sup>If the spouse is participating in the pension scheme, the participant is entitled to a survivor pension when the spouse dies. We do not consider this possibility in our analysis.

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**Table 3.2**

Indexation of the pension rights

Year	Pension increase (%)	Average wage increase (%)	General price increase (%)
2009	0.28	2.20	1.20
2008	0.00	4.73	2.50
2007	4.01	2.05	1.60
2006	2.82	3.66	1.20
2005	0.17	0.38	1.70

Source: Stichting Pensioenfonds ABP (2009). Note: Pension rights are increased on the first of January of the following year indicted in the table.

decides to continue to work full-time ( $FTE = 1$ ) until age 70, and also defers his claim of pension rights till age 70. For his pension annuity at age 70, this has the following consequences. First, the pension annuity that is deferred at age 65 will be paid as of age 70 with an increased amount due to the actuarial adjustment at age 70. The amount of the annuity that is deferred is determined according to the formula:

$$FTE_{65} * PA_{op_{25-64}}^d. \quad (3.3)$$

The first factor determines the share of the pension annuity deferred at age 65. The fiscal regulation requires that the fraction of the pension that the employee defers is equal to at least the fraction of the work time that the employee works. In our case, the employee continues to work full-time at age 65 so the FTE must be equal to 1. The second factor is the pension annuity at age 65 which is given by Equation (3.2). The amount of the actuarial increase is determined according to the formula:

$$FTE_{65} * PA_{op_{25-64}}^d * (AF_{op_{70}} - 1). \quad (3.4)$$

The third factor is the actuarial adjustment due to the late claim of pension rights: pension rights are actuarially adjusted in case they are claimed before or after the official retirement age of 65 through the actuarial factor ( $AF_{op}$ ) which depends on mortality rates and a certain interest rate. Table 3.3 shows the full set of actuarial factors for all retirement ages. The actuarial factor for age 70 is equal to 1.461, increasing the deferred pension in our example by €7,160.

Second, the pension annuity at age 70 will increase due to the additional rights accumulated from age 65 until age 69 and due to the actuarial adjustment of these rights at age 70. That is, the pension rights accumulate, as in Equation (3.2), according to the formula:

$$PA_{op_{65-69}}^d = \sum_{t=65}^{69} FTE_t * AR_{op_t} * (PI_t - SPO_t). \quad (3.5)$$

These pension rights are then actuarially adjusted by the actuarial factor corresponding to the age when these rights are claimed, as in Equation (3.4):

$$PA_{op_{65-69}}^d * (AF_{op_{70}} - 1). \quad (3.6)$$

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**Table 3.3**

Actuarial factors for earlier and later retirement than at age 65

Retirement age	Actuarial factor	
	Occupational pension scheme	State pension scheme
60	0.724	-
61	0.770	-
62	0.819	-
63	0.874	-
64	0.934	-
65	1.000	1.000
66	1.074	1.054
67	1.155	1.114
68	1.246	1.181
69	1.347	1.256
70	1.461	1.342

Source: The actuarial factors of the occupational pension scheme are obtained from Stichting Pensioenfonds ABP (2010b). The actuarial factors of the state pension scheme are authors' calculation according Ministerie van Sociale Zaken en Werkgelegenheid (2008).

In our example, the accumulated pension rights between ages 65 and 69 together with the actuarial adjustment to age 70 amount to €2,836. The total amount of the pension annuity at age 70 is equal to €25,528. We denote this annuity as  $PA_{op_{25-69}}^d$ . The fiscal regulation requires that the accrued pension rights do not exceed the pensionable income. The pension fund is required to pay out the pension rights once they reach the level of the pensionable income. Our calculations take into account this fiscal limit.

Table 3.6 demonstrates a third retirement scenario where our employee retires and claims his pension at age 62. The pension annuity at age 62 is determined according to Equation (3.2) but the pension rights accumulate from age 25 to 61. We denote this annuity as  $PA_{op_{25-61}}^d$ . Claiming the pension annuity early has the consequence that it will be decreased due to the actuarial adjustment at age 62. The amount of the decrease is determined according to the formula:

$$PA_{op_{25-61}}^d * (AF_{op_{62}} - 1). \quad (3.7)$$

The actuarial adjustment factor  $AF_{op_{62}}$  at age 62 is equal to 0.819 according to Table 3.3 implying that in our example the pension annuity is decreased by €2,600.

Table 3.7 demonstrates a scenario where the employee retires partially at age 65 and fully at age 70, working half-time ( $FTE = 0.5$ ) from age 65 until age 70. We assume that he claims half of his pension rights at age 65 and defers the other half until age 70. In fact, the fiscal regulation requires that the fraction of the pension that the employee claims is equal to at most the fraction of the work time that the employee retires. Therefore, our employee could claim less of his pension rights but not more than half. For his pension annuity at age 70, this has the following consequences. First, the share of the pension annuity claimed at age 65 will stay the same for the remaining lifetime, without actuarial adjustment (since  $AF_{op_{65}} = 1$ ), giving a pension annuity of €7,766. Second, the share of the pension annuity that is deferred at age 65 will be paid as of age 70 with an increased amount due to the actuarial adjustment at age 70. The share of the pension annuity that

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**Table 3.4**

Scenario of full retirement at age 65

	61	62	63	64	65	66	67	68	69	70
	Work				Retirement					
Accrued from 25 to 64					15,531					"
										=
Claim as of 65					15,531	"	"	"	"	"
										+
Adjustment as of 65					0	"	"	"	"	"
										+
Defer to claim as of 70					0					"
										+
Adjustment as of 70										0
										+
Accrued from 65 to 69										0
										+
Adjustment as of 70										0
Accrued from 15 to 64					9,282					"
										=
Claim as of 65					9,282	"	"	"	"	"
										+
Adjustment as of 65					0	"	"	"	"	"
										+
Defer to claim as of 70					0					"
										+
Adjustment as of 70										0
OP (gross)	-	-	-	-	15,531	"	"	"	"	"
SP (gross)	-	-	-	-	9,282	"	"	"	"	"
Work inc. (gross)	30,000	"	"	"	-	-	-	-	-	-
Total inc. (gross)	30,000	"	"	"	24,814	"	"	"	"	"
Rep. rate (gross)					83%	"	"	"	"	"
Tax basis	30,053	"	"	"	24,814	"	"	"	"	"
Tax	11,059	"	"	"	4,419	"	"	"	"	"
Tax cr. general	1,987	"	"	"	925	"	"	"	"	"
Tax cr. emp. per.	1,489	"	"	"	-	-	-	-	-	-
Tax cr. emp. per. red.	0	"	"	"	-	-	-	-	-	-
Tax cr. eld.	-	-	-	-	684	"	"	"	"	"
Tax cr. eld. sin.	-	-	-	-	0	"	"	"	"	"
Tax cr. sin. par.	-	-	-	-	-	-	-	-	-	-
Tax cr. sin. par. sup.	-	-	-	-	-	-	-	-	-	-
Tax cr. combi.	-	-	-	-	-	-	-	-	-	-
Tax cr. work bonus	-	1,048	1,467	2,096	-	-	-	-	-	-
Tax cr. total	3,476	4,524	4,943	5,572	1,609	"	"	"	"	"
OP prem.	1,927	"	"	"	-	-	-	-	-	-
I.r. HI prem. w.i.	1,979	"	"	"	-	-	-	-	-	-
I.r. HI prem. OP	-	-	-	-	769	"	"	"	"	"
I.r. HI prem. SP	-	-	-	-	654	"	"	"	"	"
I.r. HI prem. w.i. com.	1,979	"	"	"	-	-	-	-	-	-
F.r. HI prem.	2,524	"	"	"	"	"	"	"	"	"
F.r. HI prem. com.	1,024	"	"	"	1,284	"	"	"	"	"
Total inc. (net)	18,991	20,039	20,458	21,087	19,340	"	"	"	"	"
Rep. rate (net)					102%	"	"	"	"	"

Notes: 1. All amounts are in euros. 2. Ditto marks (") indicate the repetition of the amount presented next to it. 3. Parameter assumptions: OP parameters: Pensionable income: €29,441. SP offset: €10,500. OP base: €18,941. Accrual rate: 0.0205. Domestic situation: Not single. Age started working: 25. Years of work at 65th birthday: 40. Pension trade-off: 0.00. Claim OP: 1.00. Defer OP: 0.00. SP parameters: SP base: €9,282. Accrual rate: 0.02. Domestic situation: Not single. Age started insured: 15. Years of insurance at 65th birthday: 50. Claim SP: 1.00. Defer SP: 0.00. Work income parameters: Work income: €30,000. FTE during work: 1.00. FTE during partial retirement: 0.00. Deductions and compensations parameters: HI premium compensation domestic situation: Not single. Tax credit domestic situation: Not single.

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**Table 3.5**

Scenario of full retirement at age 70

	61	62	63	64	65	66	67	68	69	70
	Work									Ret.
Accrued from 25 to 64					15,531					25,528
										=
Claim as of 65					0	"	"	"	"	"
										+
Adjustment as of 65					0	"	"	"	"	"
										+
Defer to claim as of 70					15,531					"
										+
Adjustment as of 70										7,160
										+
Accrued from 65 to 69										1,941
										+
Adjustment as of 70										895
Accrued from 15 to 64					9,282					12,457
										=
Claim as of 65					0	"	"	"	"	"
										+
Adjustment as of 65					0	"	"	"	"	"
										+
Defer to claim as of 70					9,282					"
										+
Adjustment as of 70										3,175
OP (gross)	-	-	-	-	-	-	-	-	-	25,528
SP (gross)	-	-	-	-	-	-	-	-	-	12,457
Work inc. (gross)	30,000	"	"	"	"	"	"	"	"	-
Total inc. (gross)	30,000	"	"	"	"	"	"	"	"	37,985
Rep. rate (gross)										127%
Tax basis	30,053	"	"	"	"	"	"	"	"	37,985
Tax	11,059	"	"	"	5,679	"	"	"	"	7,587
Tax cr. general	1,987	"	"	"	925	"	"	"	"	"
Tax cr. emp. per.	1,489	"	"	"	1,057	"	"	"	"	-
Tax cr. emp. per. red.	0	"	"	"	"	"	"	"	"	-
Tax cr. eld.	-	-	-	-	684	"	"	"	"	0
Tax cr. eld. sin.	-	-	-	-	0	"	"	"	"	"
Tax cr. sin. par.	-	-	-	-	-	-	-	-	-	-
Tax cr. sin. par. sup.	-	-	-	-	-	-	-	-	-	-
Tax cr. combi.	-	-	-	-	-	-	-	-	-	-
Tax cr. work bonus	-	1,048	1,467	2,096	419	"	210	-	-	-
Tax cr. total	3,476	4,524	4,943	5,572	3,085	"	2,876	"	"	925
OP prem.	1,927	"	"	"	"	"	"	"	"	-
I.r. HI prem. w.i.	1,979	"	"	"	"	"	"	"	"	-
I.r. HI prem. OP	-	-	-	-	0	"	"	"	"	1,264
I.r. HI prem. SP	-	-	-	-	0	"	"	"	"	878
I.r. HI prem. w.i. com.	1,979	"	"	"	"	"	"	"	"	-
F.r. HI prem.	2,524	"	"	"	"	"	"	"	"	2,524
F.r. HI prem. com.	1,024	"	"	"	"	"	"	"	"	0
Total inc. (net)	18,991	20,039	20,458	21,087	23,980	"	23,770	"	"	26,657
Rep. rate (net)										140%

Notes: 1. All amounts are in euros. 2. Ditto marks (") indicate the repetition of the amount presented next to it. 3. Parameter assumptions: OP parameters: Pensionable income: €29,441. SP offset: €10,500. OP base: €18,941. Accrual rate: 0.0205. Domestic situation: Not single. Age started working: 25. Years of work at 65th birthday: 40. Pension trade-off: 0.00. Claim OP: 0.00. Defer OP: 1.00. SP parameters: SP base: €9,282. Accrual rate: 0.02. Domestic situation: Not single. Age started insured: 15. Years of insurance at 65th birthday: 50. Claim SP: 0.00. Defer SP: 1.00. Work income parameters: Work income: €30,000. FTE during work: 1.00. FTE during partial retirement: 1.00. Deductions and compensations parameters: HI premium compensation domestic situation: Not single. Tax credit domestic situation: Not single.

### 3. IMPLICATIONS OF FULL AND PARTIAL RETIREMENT FOR REPLACEMENT RATES IN A DEFINED BENEFIT SYSTEM

**Table 3.6**

Scenario of full retirement at age 62

	61	62	63	64	65	66	67	68	69	70
	Work	Retirement								
Accrued from 25 to 61		14,366								11,766
										=
Claim as of 62		14,366	"	"	"	"	"	"	"	"
										+
Adjustment as of 62		-2,600	"	"	"	"	"	"	"	"
										+
Defer to claim as of 70		0								"
										+
Adjustment as of 70										0
										+
Accrued from 62 to 69										0
										+
Adjustment as of 70										0
Accrued from 15 to 64					9,282					"
										=
Claim as of 65					9,282	"	"	"	"	"
										+
Adjustment as of 65					0	"	"	"	"	"
										+
Defer to claim as of 70					0					"
										+
Adjustment as of 70										0
OP (gross)	-	11,766	"	"	"	"	"	"	"	"
SP (gross)	-	-	-	-	9,282	"		"	"	"
Work inc. (gross)	30,000	-	-	-	-	-	-	-	-	-
Total inc. (gross)	30,000	11,766	"	"	21,048	"	"	"	"	"
Rep. rate (gross)		39%	"	"	70%	"	"	"	"	"
Tax basis	30,053	11,766	"	"	21,048	"	"	"	"	"
Tax	11,059	3,936	"	"	3,514	"	"	"	"	"
Tax cr. general	1,987	"	"	"	925	"	"	"	"	"
Tax cr. emp. per.	1,489	-	-	-	-	-	-	-	-	-
Tax cr. emp. per. red.	0	-	-	-	-	-	-	-	-	-
Tax cr. eld.	-	-	-	-	684	"	"	"	"	"
Tax cr. eld. sin.	-	-	-	-	0	"	"	"	"	"
Tax cr. sin. par.	-	-	-	-	-	-	-	-	-	-
Tax cr. sin. par. sup.	-	-	-	-	-	-	-	-	-	-
Tax cr. combi.	-	-	-	-	-	-	-	-	-	-
Tax cr. work bonus	-	-	-	-	-	-	-	-	-	-
Tax cr. total	3,476	1,987	1,987	1,987	1,609	"	"	"	"	"
OP prem.	1,927	-	-	-	-	-	-	-	-	-
I.r. HI prem. w.i.	1,979	-	-	-	-	-	-	-	-	-
I.r. HI prem. OP	-	582	"	"	"	"	"	"	"	"
I.r. HI prem. SP	-	-	-	-	654	"	"	"	"	"
I.r. HI prem. w.i. com.	1,979	-	-	-	-	-	-	-	-	-
F.r. HI prem.	2,524	"	"	"	"	"	"	"	"	"
F.r. HI prem. com.	1,024	1,936	"	"	1,472	"	"	"	"	"
Total inc. (net)	18,991	8,647	"	"	16,855	"	"	"	"	"
Rep. rate (net)		46%	"	"	89%	"	"	"	"	"

Notes: 1. All amounts are in euros. 2. Ditto marks (") indicate the repetition of the amount presented next to it. 3. Parameter assumptions: OP parameters: Pensionable income: €29,441. SP offset: €10,500. OP base: €18,941. Accrual rate: 0.0205. Domestic situation: Not single. Age started working: 25. Years of work at 65th birthday: 40. Pension trade-off: 0.00. Claim OP: 1.00. Defer OP: 0.00. SP parameters: SP base: €9,282. Accrual rate: 0.02. Domestic situation: Not single. Age started insured: 15. Years of insurance at 65th birthday: 50. Claim SP: 1.00. Defer SP: 0.00. Work income parameters: Work income: €30,000. FTE during work: 1.00. FTE during partial retirement: 0.00. Deductions and compensations parameters: HI premium compensation domestic situation: Not single. Tax credit domestic situation: Not single.



### 3. IMPLICATIONS OF FULL AND PARTIAL RETIREMENT FOR REPLACEMENT RATES IN A DEFINED BENEFIT SYSTEM

**Table 3.7**

Scenario of partial retirement at age 65

	61	62	63	64	65	66	67	68	69	70
	Work				Partial Retirement					Ret.
Accrued from 25 to 64					15,531					20,529
										=
Claim as of 65					7,766	"	"	"	"	"
										+
Adjustment as of 65					0	"	"	"	"	"
										+
Defer to claim as of 70					7,766					"
										+
Adjustment as of 70										3,580
										+
Accrued from 65 to 69										971
										+
Adjustment as of 70										447
Accrued from 15 to 64					9,282					10,952
										=
Claim as of 65					4,641	"	"	"	"	"
										+
Adjustment as of 65					0	"	"	"	"	"
										+
Defer to claim as of 70					4,641					"
										+
Adjustment as of 70										1,587
OP (gross)	-	-	-	-	7,766	"	"	"	"	20,529
SP (gross)	-	-	-	-	4,641	"	"	"	"	10,870
Work inc. (gross)	30,000	"	"	"	15,000	"	"	"	"	-
Total inc. (gross)	30,000	"	"	"	27,407	"	"	"	"	31,399
Rep. rate (gross)					91%					105%
Tax basis	30,053	"	"	"	27,433	"	"	"	"	31,339
Tax	11,059	"	"	"	5,049	"	"	"	"	6,003
Tax cr. general	1,987	"	"	"	925	"	"	"	"	"
Tax cr. emp. per.	1,489	"	"	"	1,057	"	"	"	"	-
Tax cr. emp. per. red.	0	"	"	"	0	"	"	"	"	-
Tax cr. eld.	-	-	-	-	684	"	"	"	"	"
Tax cr. eld. sin.	-	-	-	-	0	"	"	"	"	"
Tax cr. sin. par.	-	-	-	-	-	-	-	-	-	"
Tax cr. sin. par. sup.	-	-	-	-	-	-	-	-	-	-
Tax cr. combi.	-	-	-	-	-	-	-	-	-	-
Tax cr. work bonus	-	1,048	1,467	2,096	119	"	60	-	-	-
Tax cr. total	3,476	4,524	4,943	5,572	2,785	"	2,726	"	"	1,609
OP prem.	1,927	"	"	"	963	"	"	"	"	-
I.r. HI prem. w.i.	1,979	"	"	"	990	"	"	"	"	-
I.r. HI prem. OP	-	-	-	-	384	"	"	"	"	1,016
I.r. HI prem. SP	-	-	-	-	327	"	"	"	"	766
I.r. HI prem. w.i. com.	1,979	"	"	"	990	"	"	"	"	-
F.r. HI prem.	2,524	"	"	"	"	"	"	"	"	2,524
F.r. HI prem. com.	1,024	"	"	"	1,154	"	"	"	"	954
Total inc. (net)	18,991	20,039	20,458	21,087	22,098	"	22,038	"	"	23,653
Rep. rate (net)					116%	"	116%	"	"	125%

Notes: 1. All amounts are in euros. 2. Ditto marks (") indicate the repetition of the amount presented next to it. 3. Parameter assumptions: OP parameters: Pensionable income: €29,441. SP offset: €10,500. OP base: €18,941. Accrual rate: 0.0205. Domestic situation: Not single. Age started working: 25. Years of work at 65th birthday: 40. Pension trade-off: 0.00. Claim OP: 0.50. Defer OP: 0.50. SP parameters: SP base: €9,282. Accrual rate: 0.02. Domestic situation: Not single. Age started insured: 15. Years of insurance at 65th birthday: 50. Claim SP: 0.50. Defer SP: 0.50. Work income parameters: Work income: €30,000. FTE during work: 1.00. FTE during partial retirement: 0.50. Deductions and compensations parameters: HI premium compensation domestic situation: Not single. Tax credit domestic situation: Not single.

### 3. IMPLICATIONS OF FULL AND PARTIAL RETIREMENT FOR REPLACEMENT RATES IN A DEFINED BENEFIT SYSTEM

**Table 3.8**

Scenario of partial retirement at age 65 with pension trade-off

	61	62	63	64	65	66	67	68	69	70
	Work				Partial Retirement					Ret.
Accrued from 25 to 64					15,531					19,813
										=
Claim as of 65					9,319					7,050
										+
Adjustment as of 65					0	”	”	”	”	”
										+
Defer to claim as of 70					7,766					”
										+
Adjustment as of 70										3,580
										+
Accrued from 65 to 69										971
										+
Adjustment as of 70										447
Accrued from 15 to 64					9,282					10,870
										=
Claim as of 65					4,641	”	”	”	”	”
										+
Adjustment as of 65					0	”	”	”	”	”
										+
Defer to claim as of 70					4,641					”
										+
Adjustment as of 70										1,587
OP (gross)	-	-	-	-	9,319	”	”	”	”	19,813
SP (gross)	-	-	-	-	4,641	”	”	”	”	10,870
Work inc. (gross)	30,000	”	”	”	15,000	”	”	”	”	-
Total inc. (gross)	30,000	”	”	”	28,960	”	”	”	”	30,683
Rep. rate (gross)					97%					102%
Tax basis	30,053	”	”	”	28,986	”	”	”	”	30,683
Tax	11,059	”	”	”	5,423	”	”	”	”	5,831
Tax cr. general	1,987	”	”	”	925	”	”	”	”	”
Tax cr. emp. per.	1,489	”	”	”	1,057	”	”	”	”	-
Tax cr. emp. per. red.	0	”	”	”	0	”	”	”	”	-
Tax cr. eld.	-	-	-	-	684	”	”	”	”	”
Tax cr. eld. sin.	-	-	-	-	0	”	”	”	”	”
Tax cr. sin. par.	-	-	-	-	-	-	-	-	-	-
Tax cr. sin. par. sup.	-	-	-	-	-	-	-	-	-	-
Tax cr. combi.	-	-	-	-	-	-	-	-	-	-
Tax cr. work bonus	-	1,048	1,467	2,096	119	”	60	-	-	-
Tax cr. total	3,476	4,524	4,943	5,572	2,785	”	2,726	”	”	1,609
OP prem.	1,927	”	”	”	963	”	”	”	”	-
I.r. HI prem. w.i.	1,979	”	”	”	990	”	”	”	”	-
I.r. HI prem. OP	-	-	-	-	461	”	”	”	”	981
I.r. HI prem. SP	-	-	-	-	327	”	”	”	”	766
I.r. HI prem. w.i. com.	1,979	”	”	”	990	”	”	”	”	-
F.r. HI prem.	2,524	”	”	”	”	”	”	”	”	2,524
F.r. HI prem. com.	1,024	”	”	”	1,076	”	”	”	”	990
Total inc. (net)	18,991	20,039	20,458	21,087	23,123	”	23,064	”	”	23,181
Rep. rate (net)					122%	”	121%	”	”	122%

Notes: 1. All amounts are in euros. 2. Ditto marks (”) indicate the repetition of the amount presented next to it. 3. Parameter assumptions: OP parameters: Pensionable income: €29,441. SP offset: €10,500. OP base: €18,941. Accrual rate: 0.0205. Domestic situation: Not single. Age started working: 25. Years of work at 65th birthday: 40. Pension trade-off: 0.20. Claim OP: 0.50. Defer OP: 0.50. SP parameters: SP base: €9,282. Accrual rate: 0.02. Domestic situation: Not single. Age started insured: 15. Years of insurance at 65th birthday: 50. Claim SP: 0.50. Defer SP: 0.50. Work income parameters: Work income: €30,000. FTE during work: 1.00. FTE during partial retirement: 0.50. Deductions and compensations parameters: HI premium compensation domestic situation: Not single. Tax credit domestic situation: Not single.

### 3. IMPLICATIONS OF FULL AND PARTIAL RETIREMENT FOR REPLACEMENT RATES IN A DEFINED BENEFIT SYSTEM

**Table 3.9**

Actuarial factors for pension trade-off

Retirement age	Age at which occupational pension is decreased or increased for the remaining lifetime								
	62	63	64	65	66	67	68	69	70
60	0.132	0.207	0.290	0.380	-	-	-	-	-
61		0.136	0.214	0.299	0.394	-	-	-	-
62			0.140	0.221	0.310	0.408	-	-	-
63				0.145	0.228	0.321	0.424	-	-
64					0.150	0.237	0.333	0.441	-
65						0.155	0.246	0.347	0.461

Source: Stichting Pensioenfonds ABP (2010b). Note: The ages in the left column refers to the retirement age ( $t$ ) at which the pension is increased or decreased, and the ages in the top row refers to the later age ( $t + n$ ) at which the pension is subsequently decreased or increased, respectively, for the remaining lifetime. The table presents factors only for selected retirement ages. The factors in the upper right section are not presented as they are not used in the analysis. For the complete set of factors see Stichting Pensioenfonds ABP (2010b).

is deferred (€7,766) is determined in a similar manner as in Equation (3.3) but the FTE is now equal to 0.5. The amount of the actuarial increase is determined in a similar manner as in Equation (3.4). The actuarial revaluation increases the deferred pension by €3,580. Third, the pension annuity at age 70 will increase due to the additional rights accumulated during partial retirement and due to the actuarial adjustment of these rights at age 70. The accrual of rights is determined in a similar manner as in Equation (3.5) but the FTE drops to 0.5. The actuarial increase is determined in a similar manner as in Equation (3.6). The accumulated pension rights between ages 65 and 69 together with the actuarial adjustment at age 70 amount to €1,418. The total amount of the pension annuity at age 70 is equal to €20,529.

It is possible to trade off pension rights over the (partial) retirement years. According to the rules of ABP, if the pension annuity  $PA_{op_t}$  is increased or decreased by an amount  $PT$  from the (partial) retirement age  $t$  until age  $t + n$ , then  $PA_{op_t}$  will be decreased or increased for the remaining lifetime by the amount

$$PT * PTF_{t,t+n} \quad (3.8)$$

at age  $t + n$  so that the pension trade-off is actuarially neutral. The actuarial factor  $PTF_{t,t+n}$  is prescribed by ABP and depends on the ages  $t$  and  $t + n$ . Table 3.9 documents the actuarial factors for various age combinations of  $t$  and  $t + n$ . For example, consider the retirement scenario in Table 3.7 where the employee partially retires at age 65 and starts to receive pension rights of €7,766 every year. Table 3.8 demonstrates an alternative scenario where the employee increases his pension rights by 20% from age 65 until age 70, implying a reduction of by 9.2% at age 70 for the remaining life time (where 9.2% is calculated as  $20\% * 0.461$  according to Equation (3.8)). This trade-off effectively supplements the reduced earnings during partial retirement, but also smooths out the net replacement rates and hence the income path after age 65. However, the fiscal law imposes limits on the amounts that can be traded off: to avoid that the employee cashes an excessive amount in a few years, the ratio of the annuity that is increased at the time of retirement,  $PA_{op_t} + PT$ , to the annuity

### 3. IMPLICATIONS OF FULL AND PARTIAL RETIREMENT FOR REPLACEMENT RATES IN A DEFINED BENEFIT SYSTEM

that is decreased subsequently,  $PA_{op_t} - PT * PTF_{t,t+n}$ , should be smaller than or equal to 100/75. Likewise, the ratio of the annuity that is decreased at the time of retirement,  $PA_{op_t} - PT$ , to the annuity that is increased subsequently,  $PA_{op_t} + PT * PTF_{t,t+n}$ , should be bigger than or equal to 75/100.

#### 3.2.2 The state pension scheme

The General Old Age Pensions Act (AOW) is the state pension scheme in the Netherlands, paying a flat-rate benefit to people of 65 years and older, independent of earnings, income, or premiums paid. The scheme is unfunded and based on the pay-as-you-go principle so that current pensions are financed from the current premiums paid by workers. The premiums are paid as a percentage of work income through the income tax in the name of national insurance premiums; see Section 3.3 below. However, employees do not accumulate pension rights according the premiums they pay but according to the formula:

$$PA_{sp_{15-64}}^d = \sum_{t=15}^{64} AR_{sp_t} * PB_t^d. \quad (3.9)$$

Everybody who lives in the Netherlands is insured under the scheme. The maximum period of insurance is 50 years covering the period between a person's 15th and 65th birthdays. For those who do not live in the Netherlands all this time, the benefit is adjusted proportionally. The current accrual rate (AR) is 2% per year. The pension base (PB) is determined by the government according to the net minimum wage. Its amount depends on the domestic situation (d) of the retiree which will be simplified in 2015 into three categories: single without a child (€13,310), single with a child under 18 years old (€16,766), and sharing a household with a partner (€9,282). Table 3.4 demonstrates that our hypothetical employee, whom we assume is living with a partner, is building up €186 every year for a period of 50 years, leading to an annuity of €9,282 paid as of age 65.

In 2008, the Dutch government put forward a draft law to promote employment after age 65 and to offset the financial effects of aging (Ministerie van Sociale Zaken en Werkgelegenheid, 2008). The law allows an employee to defer part or all of his state pension rights for a maximum of five years. These rights are then actuarially increased at the time of claim. However, it is not possible to accrue additional rights during the deferral period. Table 3.7 shows an example where someone claims half of his state pension rights at age 65 and defers the other half until age 70. For his pension annuity at age 70, this has the following consequences. First, the share of the pension annuity claimed at age 65 will stay the same for the remaining lifetime. Second, the share of the pension annuity that is deferred at age 65 will be paid as of age 70 with an increased amount due to the actuarial adjustment at age 70. The amount of the annuity that is deferred is determined according to the formula:

$$FTE_{65} * PA_{sp_{15-64}}^d. \quad (3.10)$$

FTE is 0.5 in our example. The first factor determines the deferred share of the pension annuity at age 65. The second factor is the pension annuity which is defined by Equation (3.9). The amount of the actuarial increase is determined according to the formula:

$$FTE_{65} * PA_{sp_{15-64}}^d * (AF_{sp_{65+NYD}} - 1). \quad (3.11)$$

### 3. IMPLICATIONS OF FULL AND PARTIAL RETIREMENT FOR REPLACEMENT RATES IN A DEFINED BENEFIT SYSTEM

The third factor is the actuarial adjustment due to later claiming. The adjustment is made through the actuarial factor which depends on mortality rates. In particular,  $AF_{sp_{65+NYD}}$  is defined as  $LE_{65}/(LE_{65} - NYD)$ .  $LE$  is the average of the life expectancies of men and women at age 65 and it is equal to 19.6 years in 2010 (according to Statistics Netherlands). The number of years of delay ( $NYD$ ) is five in our example. Table 3.3 shows the actuarial factors for other possible ages of claiming. The actuarial revaluation increases the deferred state pension by €1,587. A similar calculation applies in Table 3.5 where all pension rights are deferred until age 70.

Equation (3.11) resembles Equation (3.4). However, note that the actuarial increase due to deferral of pension rights beyond age 65 is lower in the state pension scheme than in the occupational pension scheme, since the actuarial factors are lower (see Table 3.3). This is due to the fact that the actuarial factors of the state pension scheme are driven by mortality rates only, whereas those of the occupational pension scheme are driven by the mortality rates and a certain interest rate. Section 3.5 will discuss the implications of this difference for the state pension rights.

With an assumed gross income and the calculated occupational and state pension benefits, we can compute the gross replacement rates for the type of retirement scenarios presented in Tables 3.4-3.8. For example, Table 3.4 shows that the occupational and the state pension benefits together replace 83% of the full-time work income. Since the income tax rate in the Netherlands is substantially lower after age 65, this does not immediately translate into how much the pension benefits replace previous earnings after the tax is accounted for. This is the topic of the next section.

## 3.3 The Dutch tax system

Every person who lives in the Netherlands and has some source of income is subject to the income tax. Besides, every person has to buy health insurance. The lower panel of Table 3.4 shows the calculation of income after tax and health insurance payments, which we explain here in four steps. First, we determine the basis for wage tax and national insurance premiums according to Table 3.10. In particular, we first determine gross income, including (where applicable) work income, occupational pension benefits, and state pension benefit.<sup>14</sup> We consider income on an annual basis, including holiday allowance, end-of-year bonus, etc. We then deduct the pension premiums paid to the occupational pension scheme, as calculated in Section 3.2.1, since these premiums are tax deductible. Because we assume that there are no tax deductible savings, wage payments in kind, or claims for future income, this gives the basis for the employee insurance premiums. This is also our basis for income-related Health Insurance premiums because as of 2009 employees do not pay the Unemployment Insurance premium and we assume no savings or private car use. Finally, the income-related Health Insurance premium is added to the basis for income-related Health Insurance premiums because the employer fully compensates the employee for this premium which is

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<sup>14</sup>For income tax purposes there are three types of taxable income: income from (current or past) employment and home ownership, income from a substantial interest and income from savings and investments. We consider the former only.

### 3. IMPLICATIONS OF FULL AND PARTIAL RETIREMENT FOR REPLACEMENT RATES IN A DEFINED BENEFIT SYSTEM

**Table 3.10**

Calculation of the basis for wage tax and national insurance premiums

	Gross salary
–	OP premiums
–	Company saving scheme premium
+	Wage in kind excluding private car use
+	Claims for future income
=	Basis for employee insurance premiums
–	Unemployment Insurance premium
–	Life-cycle savings scheme premium
+	Private car use
=	Basis for income-related HI premiums
+	Income-related HI premium work income compensation
=	Basis for wage tax and national insurance premiums

Source: Belastingdienst (2010a).

therefore treated as taxable income. This gives the basis for wage tax and national insurance contributions.

The Health Insurance premiums are determined as follows. Every income earner or pension receiver has to pay an income-related premium to the tax office for the state-controlled mandatory health insurance according to the formula:

$$PR_i * (GI_{it} - PP_t). \quad (3.12)$$

The premium rate (PR) is specific to the type of the premium (i) as documented in Table 3.11. The second term is the basis for the premiums as defined in Table 3.10. Depending on the type of the premium, gross income (GI) is either the income from full or part-time work, in which case the income is reduced by the amount of the pension premiums (PP), or it is the state or the occupational pension benefit, in which case PP is 0. The insured pays premiums over each source of income. The benefit agencies do not compensate, but the employer will fully compensate the insured for the premiums paid on the work income. This compensation is added to taxable income as explained above. Besides the health insurance from the state, everyone has to buy basic health insurance from a private insurer. A flat-rate health insurance premium is paid to the insurer. The premiums for a person paying

**Table 3.11**

Premiums for the health insurance schemes

Premium type	Premium rate
Flat-rate HI single	€1,262
Flat-rate HI with partner	€2,524
Income-related HI work income	7.05%
Income-related HI OP	4.95%
Income-related HI SP	7.05%

Source: Belastingdienst (2010a). Notes: HI refers to health insurance. The maximum amount of each income-related health insurance premium is €33,189. The flat-rate premium will vary from one insurer to the other. The presented rate is approximately the market average according to Belastingdienst (2010a).

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**Table 3.12**

Tax brackets and tax rates for income tax and national insurance premiums

Bracket	Annual income (€)	Premium type	Premium rate (%)	
			< Age 65	≥ Age 65
1	0 - 18,218	AOW	17.90	-
		ANW	1.10	1.10
		AWBZ	12.15	12.15
		Wage	2.30	2.30
		Total	33.45	15.55
2	18,219 - 32,738	AOW	17.90	-
		ANW	1.10	1.10
		AWBZ	12.15	12.15
		Wage	10.80	10.80
		Total	41.95	24.05
3	32,739 - 54,367	AOW	17.90	17.90
		ANW	1.10	1.10
		AWBZ	12.15	12.15
		Wage	10.85	10.85
		Total	42.00	42.00
4	≥ 54,368	AOW	17.90	17.90
		ANW	1.10	1.10
		AWBZ	12.15	12.15
		Wage	20.85	20.85
		Total	52.00	52.00

Source: Belastingdienst (2010a). Note: The national insurance premiums are for the old age pension insurance (AOW), surviving dependants' pension insurance (ANW) and general exceptional medical expenses insurance (AWBZ) schemes.

for himself or for himself and his partner are presented in Table 3.11.<sup>15</sup> The tax office will compensate the insured for the premiums paid if total income is lower than some threshold. The amount of the compensation depends on total gross income following the rules shown in Table 3.13. Table 3.4 shows the amount of each health insurance premium and the corresponding compensation for the employee we are considering.

Second, given the basis for wage tax and national insurance premiums, the amount of tax and national insurance premiums is determined according to the income related progressive tax brackets in Table 3.12.<sup>16</sup> For example, the tax basis amount of €30,053 in Table 3.4 is taxed as  $18,218 * 33.45\% + (30,053 - 18,218) * 41.95\%$  which amounts to €11,059. Note that the tax rates decrease after age 65, for the first two tax brackets, solely due to the absence of the old age pension insurance contribution, and they increase, through the four tax brackets, solely due to the increase in marginal income tax rates. Hence, retirees with low income have the lowest income tax as a fraction of their income.

<sup>15</sup>In our scenarios we assume that, unless he or she is single, our employee is the breadwinner in the household and therefore pays health insurance premiums also for the partner.

<sup>16</sup>For convenience we will use the term “tax (rate)” to refer to the sum of tax and national insurance premiums.

### 3. IMPLICATIONS OF FULL AND PARTIAL RETIREMENT FOR REPLACEMENT RATES IN A DEFINED BENEFIT SYSTEM

**Table 3.13**

Calculation of the flat-rate health insurance premium compensation

Domestic situation	Total income (€)	Amount (€)
Single	$\leq 33,743$	$1,262 - (527 + 0.05 * (TI - 19,528))$
With partner	$\leq 50,000$	$2,524 - (976 + 0.05 * (TI - 19,528))$

Source: Belastingdienst (2010b). Note: TI refers to total income.

Third, we calculate the tax credits, where applicable, to find the eventual amount of the tax to be paid. Table 3.14 presents the tax credits and their respective rules. Some of them provide a flat-rate amount while others are income related, and some of them depend on the domestic situation. The amount of a tax credit is limited by the amount of tax paid. The basis over which the credits are calculated differ. For example, Table 3.4 shows that our employee receives the work bonus as of age 62 until he retires at age 65. The work bonus amounts to €1,467 at age 63  $((30,000 - 9,042) * 7\%)$ .

Finally, given the pension premiums, taxes, tax credits, health insurance premiums and the health insurance premium compensations calculated above, the net work income and retirement income are calculated according to Table 3.15. Table 3.4 presents this calculation for our hypothetical employee who retires at age 65. In the following sections, we discuss the implications of full and partial retirement for the occupational pension rights, state pension rights, and the replacement rates given the described pension and tax system.

## 3.4 Occupational pension income analysis

In the case of full retirement, early and late claiming of pension rights has the following implications. As we demonstrated in Section 3.2.1, for claims later than at age 65, the pension annuity increases by the amount given in Equation (3.4). In particular, since the actuarial factors for ages later than 65 in Table 3.3 are higher than one, the pension annuity is actuarially increased by the third factor in that equation. The annuity also increases due to the additional rights accrued after age 65 according to Equation (3.6). Similarly the pension annuity decreases for claims earlier than at age 65. The total amount of the gain from the actuarial increase or that of the loss from the actuarial decrease depends on the total number of years the beneficiary claims pension rights.

In the case of partial retirement, the pension annuity decreases and increases, in the same manner as in the full retirement case, if partial retirement takes place, respectively, before or after age 65. The annuity is actuarially adjusted at two instances, first at the beginning and then at the end of partial retirement, as shown in Table 3.7. If partial retirement starts before age 65 and ends after age 65, the annuity is actuarially decreased when it is claimed the first time, according to Equation (3.7), and it is actuarially increased when it is claimed the second time, according to Equation (3.4). If the actuarial losses and gains cancel out, partial retirement can constitute a costless substitute to full retirement at age 65. A beneficiary might then prefer partial retirement with the advantage that it provides a smooth transition into full retirement. Forman and Scahill (2003, 2004) demonstrate a



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**Table 3.14**  
Tax credits

Credit type	Credit basis	Credit basis amount (€)	Credit rate (%)		Credit amount (€)		Credit maximum (€)	
			< Age 65	≥ Age 65	< Age 65	≥ Age 65	< Age 65	≥ Age 65
General tax credit	Tax basis	-	-	-	1,987	925	-	-
Employed person's tax credit	Tax basis	0 - 9,041 ≥ 9,042	1.737	0.807	CB * CR	-	-	-
			11.888	8.779				
Employed person's tax credit reduction	Work income	0 - 43,385 ≥ 43,386	-	-	-	-	-	-
			1.250	0.581				
Elderly person's tax credit	Total income	0 - 34,933 ≥ 34,934	-	-	684	-	-	-
			-	-				
Elderly single person's tax credit	-	-	-	-	418	-	-	-
			-	-				
Single parent's tax credit	-	-	-	-	945	440	-	-
			-	-				
Single parent's supplementary tax credit	Work income	-	4.300	4.300	CB * CR	-	1,513	705
			-	-				
Combination tax credit	Work income	0 - 4,706 4,707 - 33,233	-	-	-	-	-	-
			3.800	1.770				
Work bonus	Work income	0 - 9,041 9042 - 55,840	-	-	-	-	-	-
			5.000	2.000				
			7.000	2.000				
			10.000	1.000				

Source: Belastingdienst (2010a). Notes: CB refers to the credit basis amount, CR refers to the credit rate, and FR refers to a flat-rate credit. Single parent's tax credit: To be eligible for the credit the person should have no tax partner, have a child younger than 27 years old. Single parent's supplementary tax credit: To be eligible for the credit the household should be receiving the single parent's tax credit and have income from work, and have a child younger than 16 years old. Combination tax credit: It amounts to €775 before age 65 and €360 as of age 65. To be eligible for the credit the person should be entitled to the Single parent's supplementary tax credit, have income from work, have children under 12 years old, and be single. Work bonus: To be eligible for the credit the person should have income from work. The presented credit rates and the credit maximum amounts refer to those at ages 62, 63, 64, 65, 66 and 67.

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**Table 3.15**

Calculation of income after tax and health insurance payments

	Gross income
–	OP premiums
–	Tax
+	Tax credits
–	Income-related HI premium work income
–	Income-related HI premium OP
–	Income-related HI premium SP
+	Income-related HI premium work income compensation
–	Flat-rate HI premium
+	Flat-rate HI premium compensation
=	Net income

Source: Belastingdienst (2010a) and authors' calculation.

similar way of achieving actuarial neutrality in partial retirement in a final average pay defined benefit system and argue that actuarial neutrality is essential to avoid an actuarial gain or loss as a result of paying benefits prior to full retirement so that the employee and the employer can agree on a partial retirement arrangement.

In Section 3.2.1, we discussed that a beneficiary can trade-off occupational pension rights over the (partial) retirement years. For example, he can receive an increased pension for several years at the expense of a lower pension later, to supplement his reduced pension in the case of early retirement or partial retirement. The lifetime financial impact of this trade-off depends on the total number of years the beneficiary claims pension rights. For example, in the case of an increased pension in exchange for a lower pension later, the total loss will exceed the total gain if the period associated with the lower pension is long enough.

## 3.5 State pension income analysis

In this section, we discuss two issues regarding the proposed scheme on deferring the state pension at age 65. The first issue is the financial impact of deferring the state pension for the beneficiary, and on the aggregate level for the government. The framework we have built for the retirement scenarios in Tables 3.4-3.7 allows us to quantify this impact. For a beneficiary, we determine the lifetime financial gain or loss from deferring the state pension as in the following example. Between ages 65 and 70, where the deferral period is five years, the beneficiary loses from not receiving the state pension, but may gain from not paying tax on the state pension, from receiving the elderly person's tax credit for decreased income, from not paying the income-related health insurance premium on the state pension, and from receiving the flat-rate health insurance premium compensation for decreased income. After age 70, where we assume that the beneficiary lives 13.5 years, which is the life expectancy for men at age 70 in the Netherlands, the beneficiary gains from receiving increased state pension because of the actuarial increase (see Table 3.3), but may lose from paying tax on the increased state pension, from not receiving the elderly person's tax credit for increased income, from paying the income-related health insurance premium on the increased pension, and from not receiving the flat-rate health insurance premium compensation for increased

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**Table 3.16**

Lifetime financial impact of deferring the state pension

Nr. of yrs deferred	Life expectancy	Domestic situation	
		With a partner	Single
2	16.47 (for men at 67)	−348	−482
3	15.71 (68)	−243	−335
4	14.96 (69)	104	168
5	14.23 (70)	775	1,136
2	19.55 (for wom. at 67)	2,100	3,033
3	18.73 (68)	3,587	5,159
4	17.91 (69)	5,426	7,803
5	17.10 (70)	7,709	11,084

Notes: Amounts in euros. The table assumes that the beneficiary never worked and therefore never received work income or built up occupational pension. The life expectancy figures are for the year 2010 and obtained from the Central Bureau of Statistics of Netherlands.

income.

Among these listed sources of gains and losses, the amounts of income tax, the elderly person's tax credit and the flat-rate health insurance premium compensation depend on the level of total income, including the state pension for every beneficiary but also any occupational pension. We first consider the case where the beneficiary has the state pension as the only source of retirement income so that our calculation of the financial impact of deferring the state pension is free from the parameters of the occupational pension. We assume that the beneficiary receives no income during the deferral period. We then consider the case where the beneficiary has an occupational pension as an additional source of retirement income. In this case we assume that the beneficiary works and therefore receives work income during the deferral period.

Table 3.16 presents the lifetime financial impact of deferring the full amount of the state pension for two, three, four and five years, for two categories of life expectancy (men and women) and for two domestic situations (living with a partner and single). The table reveals clear patterns of gains and losses. First, the gains increase with the number of years of deferral. Second, the gains are larger for women than for men because of women's longer life expectancy. Third, the gains and losses are larger for singles than for beneficiaries with a partner. For men, the gain from receiving increased state pension during the access period falls short of the loss from not receiving the state pension during the deferral period when the state pension is deferred for two or three years. For longer deferral periods and for women, the gains offset the losses.

In the analysis above, we assumed that the beneficiary defers the full amount of the state pension. Instead, he might prefer to defer only a fraction of it, for example, in the case of partial retirement. In that case, the gains and losses presented in Table 3.16 change proportionally with the fraction of the state pension deferred at age 65.

The net impact of deferring the state pension will be different when the beneficiary also has additional income from work or from an occupational pension. For the income amounts in Tables 3.4 and 3.5, we find that the lifetime losses increase in the following manner.

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Among the aforementioned sources of gains and losses, the amounts of the tax, the elderly person's tax credit and the flat-rate health insurance premium compensation depend on the level of total income. When the occupational pension raises total income, the beneficiary will enter a higher tax bracket. Moreover, when total income exceeds the respective thresholds in Tables 3.13 and 3.14, the beneficiary no longer receives the elderly person's tax credit and the health insurance premium compensation. The occupational pension raises the total income especially when it is deferred, due to the actuarial increase by the time the pension is claimed. As a result, the loss from paying tax during the access period can exceed the gain from not paying tax during the deferral period, and the chances that the beneficiary loses the elderly person's tax credit and the health insurance premium compensation during the access period increase. As a consequence, the losses increase during the access period, and they might increase sufficiently enough to turn the lifetime gains to losses or to increase the losses presented in Table 3.16. The net financial impact of deferring the state pension then depends on the work income and the occupational pension, as specified in Tables 3.4-3.8, and it is difficult to draw general conclusions.

At the micro level, Table 3.16 suggests that when the beneficiary has the state pension as the only source of retirement income, the amount of the lifetime gain from deferring the state pension appears rather limited to attract the beneficiary to defer his state pension. However, when the beneficiary has an occupational pension as an additional source of retirement income, deferring the state pension results in lifetime losses and, depending on how large the losses are, this might deter the beneficiary to defer his state pension. The losses may increase because of the increase in the tax paid on the state pension and the reduction or the total loss of the health insurance premium compensation and the elderly person's tax credit during the access period. Therefore, the policy might consider exempting the employee from losing the latter benefits in case he decides to work longer and hence defer his state pension.

At the macro level, the results have the following implication. The gain of a beneficiary is the loss of the government. The presented amounts suggest that the gain for the government is rather limited. These amounts can be aggregated, with an estimate of the number of beneficiaries who would defer their state pension, to estimate the impact of the proposed scheme for the public finances. However, the amounts depend on the labor market status of the beneficiary. The financial impact for public finances depends on the amounts of work income and occupational pension. For example, if the proposed state pension scheme attracts people to work during the deferral period, the government will gain from tax on work income which may be substantial.

The second issue of the proposed scheme is the amount of the actuarial increase in the state pension in comparison to that in the occupational pension. If the state and the occupational pensions are deferred at age 65, the actuarial increase for deferral is lower in the state pension scheme than that in the occupational pension scheme. This is because the actuarial factors of the proposed state pension scheme are lower than those of the occupational pension scheme as shown in Table 3.3. This owes to the fact that the actuarial factors of the state pension scheme are driven by the mortality rates only, whereas those of the occupational pension scheme are driven by the mortality rates and a certain interest rate to account for the return on invested pension premiums. That is, the occupational pension fund can support higher actuarial factors because the fund generates returns from

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the investment of the premiums paid during the deferral period. It seems difficult for the government to increase the actuarial factors to the level of those of the occupational pension fund because the state pension system is unfunded so that the government cannot generate returns on the premiums.

The discussion above suggests that, as far as the actuarial increases are concerned, deferring the state pension is not as attractive as deferring the occupational pension. In fact, Sanders et al. (2010) show that the beneficiary might be better off by claiming the state pension annuity early and using it to buy an annuity product from a private insurance company. For example, Table 3.7 shows that, due to partial deferral of the state and the occupational pensions at age 65 until age 70, the state pension increases by €1,587, while the occupational pension increases by €3,580, according to Equations (3.11) and (3.4), respectively. The total actuarial increase amounts to €5,167. Instead, at age 65, the employee could give up deferring his state pension rights of €4,641 but defer more of his occupational pension rights just as much as €4,641. The actuarial increase in the occupational pension would then have amounted to €5,728, which is about 11% higher than the increase of €5,167. This corresponds to a 2 percentage points increase in the replacement rate at age 70.

However, in three cases a beneficiary might still defer his state pension rather than the occupational pension. First, if the employee defers all his occupational pension, as for example in Table 3.5 where the regulation requires the employee to defer all his occupational pension since he continues to work full-time, then there is no room for substitution. Second, if the occupational pension itself is too low, again, there is no room to increase the deferred share of the occupational pension. Third, with a behavioral motive rather than a financial one, a beneficiary might prefer to defer his state pension if doing so is perceived less risky or becomes the default option. This is supported by Madrian and Shea (2001) who show that a substantial fraction of the 401(k) participants opt for the default fund allocation suggested by their employers which actually yields low returns. Besides, employees might defer their state pension if the government provides a higher actuarial increase to the individuals who will participate in the labor market after age 65 as an incentive for working longer (den Butter and van Sonsbeek, 2008).

## 3.6 Replacement rate analysis

Tables 3.4-3.7 demonstrated in selected retirement scenarios the calculation of the gross and net replacement rates for a hypothetical employee at the given parameters of an occupational pension scheme, the state pension scheme, and the Dutch tax system. We consider in total 35 different retirement scenarios and study them in the same way we study the retirement scenarios in Tables 3.4-3.7. These are scenarios of full retirement at each age from 60 to 70, and scenarios of partial retirement with durations of five, four, three and two years at each age from 60 to 65. We first define the baseline values for work income and state and occupational pensions and calculate the associated replacement rates for these retirement scenarios. We then analyze the sensitivity of the replacement rates in these retirement scenarios to the changes in the baseline values.

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#### 3.6.1 Baseline analysis

We consider the parameter values in the note to Table 3.4 as the baseline and accordingly calculate gross and net replacement rates for various types of retirement scenarios. Table 3.17 presents the gross replacement rates, defined as the ratio of gross retirement income over gross work income. Retirement income includes work income in the case of partial retirement. We assume that the work income represents the average lifetime work income. The table shows that the gross replacement rate at age 65 is 83%, which can be compared to the gross replacement rate of 88.1% calculated by OECD (2011) using the national parameters and rules applying in 2008. Note that we consider only pension savings and ignore any type of personal savings. In fact, in the Netherlands, many people make mortgage payments and therefore have less income available for consumption during the work years, while they finish their payments and have more income available for consumption during the retirement years. This means that personal savings might affect the amount of income available for consumption before and after retirement and hence the interpretation of a replacement rate.

Table 3.18 presents the net replacement rates for the retirement scenarios in Table 3.17, defined as the ratio of net retirement income over net work income. Table 3.5 shows that the net work income changes with age in the last years before retirement, due to the change in the work bonus with age (see Table 3.14) or in the tax rate at age 65 (Table 3.12). We assume that the work income we consider in our replacement rate calculation is not affected by these changes. We have illustrated the calculation of the net replacement rates for particular retirement scenarios in Tables 3.4-3.7. Table 3.18 shows that the baseline net replacement rate at age 65 is 102%, which can be compared to the net replacement rate of 99.8% calculated by OECD (2011).

The upper panel of Table 3.18 shows that before age 65 the net replacement rates are about 7 percentage points higher, and as of age 65 they are about 20 percentage points higher than the corresponding gross replacement rates in Table 3.17. This is because the tax rate as of age 65 is lower than that before age 65, as shown in Table 3.12. The lower panel of Table 3.18 shows that before age 65 the net replacement rates are about 10 percentage points higher than the gross replacement rates in Table 3.17. However, as of age 65, the net replacement rates during partial retirement are 25 percentage points higher, while those during full retirement are about 19 percentage points higher than the corresponding gross replacement rates in Table 3.17. The 6 percentage points difference owes to the fact that during partial retirement the employee is granted the labor tax credit for his participation in the labor market, while he does not receive this tax credit once he is fully retired. In the rest of the analysis we consider only the net replacement rates.

The upper panel of Table 3.18 reveals the following results. First, the diagonal elements show that delaying full retirement results in progressively higher replacement rates. This is because the actuarial factors in Table 3.3 progressively increase because of the progressive increase in the mortality rate with age. The progressively increasing actuarial factors then progressively raise, for example after age 65, the occupational pension annuity in Equations (3.4) and (3.6), and the state pension annuity in Equation (3.11). A direct implication is that the price of leisure increases with age and the table demonstrates how much it increases in terms of the replacement rates. Second, before age 65, the retirement income

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**Table 3.17**

Gross replacement rates under baseline parameter values

Full ret. age	Replacement rate at the indicated age										
	60	61	62	63	64	65	66	67	68	69	70
60	0.33	0.33	0.33	0.33	0.33	0.64	0.64	0.64	0.64	0.64	0.64
61	-	0.36	0.36	0.36	0.36	0.67	0.67	0.67	0.67	0.67	0.67
62	-	-	0.39	0.39	0.39	0.70	0.70	0.70	0.70	0.70	0.70
63	-	-	-	0.43	0.43	0.74	0.74	0.74	0.74	0.74	0.74
64	-	-	-	-	0.47	0.78	0.78	0.78	0.78	0.78	0.78
65	-	-	-	-	-	0.83	0.83	0.83	0.83	0.83	0.83
66	-	-	-	-	-	-	0.90	0.90	0.90	0.90	0.90
67	-	-	-	-	-	-	-	0.97	0.97	0.97	0.97
68	-	-	-	-	-	-	-	-	1.06	1.06	1.06
69	-	-	-	-	-	-	-	-	-	1.16	1.16
70	-	-	-	-	-	-	-	-	-	-	1.27
Partial ret. age											
60 (5 yrs)	0.66*	0.66*	0.66*	0.66*	0.66*	0.73	0.73	0.73	0.73	0.73	0.73
61	-	0.68*	0.68*	0.68*	0.68*	0.83*	0.78	0.78	0.78	0.78	0.78
62	-	-	0.70*	0.70*	0.70*	0.85*	0.85*	0.84	0.84	0.84	0.84
63	-	-	-	0.71*	0.71*	0.87*	0.87*	0.87*	0.90	0.90	0.90
64	-	-	-	-	0.74*	0.89*	0.89*	0.89*	0.89*	0.97	0.97
65	-	-	-	-	-	0.91*	0.91*	0.91*	0.91*	0.91*	1.05
60 (4 yrs)	0.66*	0.66*	0.66*	0.66*	0.40	0.71	0.71	0.71	0.71	0.71	0.71
61	-	0.68*	0.68*	0.68*	0.68*	0.75	0.75	0.75	0.75	0.75	0.75
62	-	-	0.70*	0.70*	0.70*	0.85*	0.80	0.80	0.80	0.80	0.80
63	-	-	-	0.71*	0.71*	0.87*	0.87*	0.86	0.86	0.86	0.86
64	-	-	-	-	0.74*	0.89*	0.89*	0.89*	0.92	0.92	0.92
65	-	-	-	-	-	0.91*	0.91*	0.91*	0.91*	0.99	0.99
60 (3 yrs)	0.66*	0.66*	0.66*	0.38	0.38	0.69	0.69	0.69	0.69	0.69	0.69
61	-	0.68*	0.68*	0.68*	0.42	0.72	0.72	0.72	0.72	0.72	0.72
62	-	-	0.70*	0.70*	0.70*	0.76	0.76	0.76	0.76	0.76	0.76
63	-	-	-	0.71*	0.71*	0.87*	0.82	0.82	0.82	0.82	0.82
64	-	-	-	-	0.74*	0.89*	0.89*	0.88	0.88	0.88	0.88
65	-	-	-	-	-	0.91*	0.91*	0.91*	0.94	0.94	0.94
60 (2 yrs)	0.66*	0.66*	0.36	0.36	0.36	0.67	0.67	0.67	0.67	0.67	0.67
61	-	0.68*	0.68*	0.39	0.39	0.70	0.70	0.70	0.70	0.70	0.70
62	-	-	0.70*	0.70*	0.43	0.74	0.74	0.74	0.74	0.74	0.74
63	-	-	-	0.71*	0.71*	0.78	0.78	0.78	0.78	0.78	0.78
64	-	-	-	-	0.74*	0.89*	0.84	0.84	0.84	0.84	0.84
65	-	-	-	-	-	0.91*	0.91*	0.90	0.90	0.90	0.90

Notes: The replacement rates with an asterisk (\*) represents those during partial retirement. Assumptions about full retirement as in Table 3.5: FTE during partial retirement is 1.00. Defer OP is 1.00. Defer SP is 1.00. Assumptions about partial retirement as in Table 3.7: FTE during partial retirement is 0.50. Defer OP is 0.50. Defer SP is 0.50. The table shows the replacement rates before taxes and any contributions.

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consists of only the occupational pension and the accumulated occupational pension rights are actuarially decreased because of early retirement, as discussed in Sections 3.2.1 and 3.4. Consequently, the occupational pension replaces only less than half of the previous earnings at the assumed parameter values. Unless the beneficiary is participating in a private pension scheme, early retirement appears to restrict retirement income substantially. In fact, the early retirement schemes introduced in mid-nineties (and abolished in 2006) aimed at a gross replacement rate of about 70%. Third, as a standing policy goal, the pension system in the Netherlands aims to maintain the living standard of employees before retirement with a target net replacement rate of 100% at age 65. The table shows that the current pension system achieves this target level with a net replacement rate of 102% at age 65.

The lower panel of Table 3.18 reveals the following results. First, the diagonal elements show that delaying partial retirement results in higher replacement rates in partial retirement. Delaying partial retirement also results in higher replacement rates in full retirement but the amount of the increase is lower than that in the case of delaying full retirement because only a fraction of the pension rights are delayed at the time of partial retirement. Second, when we compare partial retirement in the lower panel to full retirement at the corresponding ages in the upper panel, we observe that the replacement rates are about two times larger, before age 65. This is because during partial retirement the work income provides an additional source of income and it supplements the decreased occupational pension up to the level of the occupational pension in the case of full retirement. This suggests that in the case of full retirement before age 65, the occupational pension constitutes the only source of retirement income and it may not provide a sufficient amount of income replacement. Therefore, the employee may wish to partially retire to bring his replacement rate up to a level considered to be sufficient and smooth his income path towards full retirement. A caveat is that if partial retirement ends several years before age 65, the employee will realize a substantial loss in his total income until he starts to receive his state pension income at age 65. This suggests that partial retirement should precede immediately before the state pension age. On the other hand, when we compare partial retirement in the lower panel to full retirement at the corresponding ages in the upper panel, we observe that the difference between the replacement rates as of age 65 is smaller than that before age 65. This is because, as of age 65, the employee receives half of the state pension in the case of partial retirement in the lower panel, while he receives the full amount of the state pension in the case of full retirement in the upper panel. The state pension played no role in retirement income before age 65. This suggests that in the case of full retirement as of age 65, the state pension may sufficiently supplement the occupational pension so that the employee might not need to partially retire to supplement his occupational pension with work income as much as he might need to before age 65. Third, as a standing policy goal, the Dutch pension system aims to meet a minimum net replacement rate level of 70% in full or partial retirement. Table 3.18 shows that the current pension system achieves a net replacement rate of about 80% during partial retirement, well above the target level.

In Table 3.18 we assumed that the employee defers his state pension as of age 65, partially in the case of partial retirement and fully in the case of full retirement according to the proposed state pension scheme explained in Section 3.2.2. In fact, the employee is not allowed to defer his state pension in the current state pension scheme. Table 3.19 presents



### 3. IMPLICATIONS OF FULL AND PARTIAL RETIREMENT FOR REPLACEMENT RATES IN A DEFINED BENEFIT SYSTEM

**Table 3.18**

Net replacement rates under baseline parameter values

Full ret. age	Replacement rate at the indicated age										
	60	61	62	63	64	65	66	67	68	69	70
60	0.40	0.40	0.40	0.40	0.40	0.82	0.82	0.82	0.82	0.82	0.82
61	-	0.43	0.43	0.43	0.43	0.85	0.85	0.85	0.85	0.85	0.85
62	-	-	0.46	0.46	0.46	0.89	0.89	0.89	0.89	0.89	0.89
63	-	-	-	0.49	0.49	0.93	0.93	0.93	0.93	0.93	0.93
64	-	-	-	-	0.53	0.97	0.97	0.97	0.97	0.97	0.97
65	-	-	-	-	-	1.02	1.02	1.02	1.02	1.02	1.02
66	-	-	-	-	-	-	1.09	1.09	1.09	1.09	1.09
67	-	-	-	-	-	-	-	1.17	1.17	1.17	1.17
68	-	-	-	-	-	-	-	-	1.26	1.26	1.26
69	-	-	-	-	-	-	-	-	-	1.32	1.32
70	-	-	-	-	-	-	-	-	-	-	1.40
Partial ret.											
60 (5 yrs)	0.76*	0.76*	0.77*	0.78*	0.79*	0.92	0.92	0.92	0.92	0.92	0.92
61	-	0.77*	0.78*	0.79*	0.80*	1.08*	0.97	0.97	0.97	0.97	0.97
62	-	-	0.80*	0.80*	0.81*	1.10*	1.10*	1.03	1.03	1.03	1.03
63	-	-	-	0.82*	0.83*	1.12*	1.12*	1.11*	1.09	1.09	1.09
64	-	-	-	-	0.84*	1.14*	1.14*	1.14*	1.14*	1.16	1.16
65	-	-	-	-	-	1.16*	1.16*	1.16*	1.16*	1.16*	1.25
60 (4 yrs)	0.76*	0.76*	0.77*	0.78*	0.46	0.90	0.90	0.90	0.90	0.90	0.90
61	-	0.77*	0.78*	0.79*	0.80*	0.94	0.94	0.94	0.94	0.94	0.94
62	-	-	0.80*	0.80*	0.81*	1.10*	0.99	0.99	0.99	0.99	0.99
63	-	-	-	0.82*	0.83*	1.12*	1.12*	1.05	1.05	1.05	1.05
64	-	-	-	-	0.84*	1.14*	1.14*	1.14*	1.11	1.11	1.11
65	-	-	-	-	-	1.16*	1.16*	1.16*	1.16*	1.19	1.19
60 (3 yrs)	0.76*	0.76*	0.77*	0.44	0.44	0.87	0.87	0.87	0.87	0.87	0.87
61	-	0.77*	0.78*	0.79*	0.48	0.91	0.91	0.91	0.91	0.91	0.91
62	-	-	0.80*	0.80*	0.81*	0.95	0.95	0.95	0.95	0.95	0.95
63	-	-	-	0.82*	0.83*	1.12*	1.01	1.01	1.01	1.01	1.01
64	-	-	-	-	0.84*	1.14*	1.14*	1.07	1.07	1.07	1.07
65	-	-	-	-	-	1.16*	1.16*	1.16*	1.14	1.14	1.14
60 (2 yrs)	0.76*	0.76*	0.43	0.43	0.43	0.85	0.85	0.85	0.85	0.85	0.85
61	-	0.77*	0.78*	0.46	0.46	0.89	0.89	0.89	0.89	0.89	0.89
62	-	-	0.80*	0.80*	0.49	0.93	0.93	0.93	0.93	0.93	0.93
63	-	-	-	0.82*	0.83*	0.97	0.97	0.97	0.97	0.97	0.97
64	-	-	-	-	0.84*	1.14*	1.03	1.03	1.03	1.03	1.03
65	-	-	-	-	-	1.16*	1.16*	1.09	1.09	1.09	1.09

Notes: The replacement rates with an asterisk (\*) represents those during partial retirement. Assumptions about full retirement as in Table 3.5: FTE during partial retirement is 1.00. Defer OP is 1.00. Defer SP is 1.00. Assumptions about partial retirement as in Table 3.7: FTE during partial retirement is 0.50. Defer OP is 0.50. Defer SP is 0.50. The table shows the replacement rates net of taxes and any contributions. Other assumptions: Work income is €30,000. Domestic situation is not single. Service length is 40 years. Full-time equivalent during the career years is 1.00.

### 3. IMPLICATIONS OF FULL AND PARTIAL RETIREMENT FOR REPLACEMENT RATES IN A DEFINED BENEFIT SYSTEM

**Table 3.19**

Net replacement rates when there is no state pension deferral

Full ret. age	Replacement rate at the indicated age										
	60	61	62	63	64	65	66	67	68	69	70
60	0.40	0.40	0.40	0.40	0.40	0.82	0.82	0.82	0.82	0.82	0.82
61	-	0.43	0.43	0.43	0.43	0.85	0.85	0.85	0.85	0.85	0.85
62	-	-	0.46	0.46	0.46	0.89	0.89	0.89	0.89	0.89	0.89
63	-	-	-	0.49	0.49	0.93	0.93	0.93	0.93	0.93	0.93
64	-	-	-	-	0.53	0.97	0.97	0.97	0.97	0.97	0.97
65	-	-	-	-	-	1.02	1.02	1.02	1.02	1.02	1.02
66	-	-	-	-	-	-	1.07	1.07	1.07	1.07	1.07
67	-	-	-	-	-	-	-	1.13	1.13	1.13	1.13
68	-	-	-	-	-	-	-	-	1.20	1.20	1.20
69	-	-	-	-	-	-	-	-	-	1.28	1.28
70	-	-	-	-	-	-	-	-	-	-	1.32
Partial ret. age											
60 (5 yrs)	0.76*	0.76*	0.77*	0.78*	0.79*	0.92	0.92	0.92	0.92	0.92	0.92
61	-	0.77*	0.78*	0.79*	0.80*	1.24*	0.96	0.96	0.96	0.96	0.96
62	-	-	0.80*	0.80*	0.81*	1.25*	1.25*	1.01	1.01	1.01	1.01
63	-	-	-	0.82*	0.83*	1.27*	1.27*	1.27*	1.06	1.06	1.06
64	-	-	-	-	0.84*	1.30*	1.30*	1.29*	1.29*	1.12	1.12
65	-	-	-	-	-	1.32*	1.32*	1.32*	1.32*	1.32*	1.19
60 (4 yrs)	0.76*	0.76*	0.77*	0.78*	0.46	0.90	0.90	0.90	0.90	0.90	0.90
61	-	0.77*	0.78*	0.79*	0.80*	0.94	0.94	0.94	0.94	0.94	0.94
62	-	-	0.80*	0.80*	0.81*	1.25*	0.98	0.98	0.98	0.98	0.98
63	-	-	-	0.82*	0.83*	1.27*	1.27*	1.03	1.03	1.03	1.03
64	-	-	-	-	0.84*	1.30*	1.30*	1.29*	1.09	1.09	1.09
65	-	-	-	-	-	1.32*	1.32*	1.32*	1.32*	1.15	1.15
60 (3 yrs)	0.76*	0.76*	0.77*	0.44	0.44	0.87	0.87	0.87	0.87	0.87	0.87
61	-	0.77*	0.78*	0.79*	0.48	0.91	0.91	0.91	0.91	0.91	0.91
62	-	-	0.80*	0.80*	0.81*	0.95	0.95	0.95	0.95	0.95	0.95
63	-	-	-	0.82*	0.83*	1.27*	1.00	1.00	1.00	1.00	1.00
64	-	-	-	-	0.84*	1.30*	1.30*	1.05	1.05	1.05	1.05
65	-	-	-	-	-	1.32*	1.32*	1.32*	1.11	1.11	1.11
60 (2 yrs)	0.76*	0.76*	0.43	0.43	0.43	0.85	0.85	0.85	0.85	0.85	0.85
61	-	0.77*	0.78*	0.46	0.46	0.89	0.89	0.89	0.89	0.89	0.89
62	-	-	0.80*	0.80*	0.49	0.93	0.93	0.93	0.93	0.93	0.93
63	-	-	-	0.82*	0.83*	0.97	0.97	0.97	0.97	0.97	0.97
64	-	-	-	-	0.84*	1.30*	1.02	1.02	1.02	1.02	1.02
65	-	-	-	-	-	1.32*	1.32*	1.08	1.08	1.08	1.08

Notes: The replacement rates with an asterisk (\*) represents those during partial retirement. Assumptions about full retirement: FTE during partial retirement is 1.00. Defer OP is 1.00. Defer SP is 0.00. Assumptions about partial retirement: FTE during partial retirement is 0.50. Defer OP is 0.50. Defer SP is 0.00.

### 3. IMPLICATIONS OF FULL AND PARTIAL RETIREMENT FOR REPLACEMENT RATES IN A DEFINED BENEFIT SYSTEM

the net replacement rates when the state pension is not deferred at age 65. A particular result in the lower panel of Table 3.19 is that the replacement rates during partial retirement as of age 65 are substantially higher than the corresponding replacement rates in Table 3.18. However, the income path towards full retirement is much more smooth when the state pension is deferred partially at age 65 in Table 3.18. This suggests that, in the case of partial retirement as of age 65, the part-time work income may sufficiently supplement the partial occupational pension so that the employee might prefer to defer his state pension, at least partially, to smooth his income path towards full retirement. In a similar manner, if the employee decides to continue to work full-time at age 65, he might prefer to defer all his state pension. Besides, the lower income tax rate as of age 65 and the tax relief on the premiums paid to the occupational pension scheme already make it attractive to continue to work beyond age 65. All this implies that employees shall be given the opportunity to defer their state pension so that they can adjust the composition of their income and smooth their income path towards full retirement.

In the remainder of our analysis, we assume that the employee prefers to defer his state pension as of age 65, partially in the case of partial retirement and fully in the case of full retirement. The first reason for this assumption is that if the employee decides to continue to work part-time or full-time at age 65, he would prefer to defer his state pension, at least partially, as suggested above. A second reason for this assumption is the following. In Section 3.5 we argued that during partial retirement the employee is better off if he does not defer his state pension but defers more of his occupational pension because the actuarial increase in the state pension is lower than that in the occupational pension. However, we also argued that the government cannot provide a higher actuarial increase in the state pension. Therefore, we assume that the employee accepts the proposed actuarial increase in the state pension as it is and defers his state pension.

#### 3.6.2 Sensitivity analysis

In the following subsections we analyze the sensitivity of the replacement rates in Table 3.18 to deviations from the baseline parameter values. We vary the values of selected parameters concerning labor market characteristics of an employee and the pension system.

##### **Work income**

In our baseline analysis in Table 3.18 we assumed that the employee earns a gross income of €30,000 a year, which is roughly the average gross wage in the Netherlands. In this section, we consider two alternative levels of work income: a low income level of €15,000, which is roughly the gross minimum wage in the Netherlands, and a high income level of €60,000. Tables 3.20 and 3.21 present the net replacement rates for these incomes.

The comparison of the replacement rates in the upper panels of the tables reveals the following results. First, in the case of early retirement, when the retirement income consists of only the occupational pension, low income earners realize a lower replacement rate before age 65. This is because low income earners accumulate less occupational pension rights relative to their work income. In particular, as work income decreases, the pension base (defined by Equation (3.2)), decreases at a higher pace since the state pension offset is fixed.

### 3. IMPLICATIONS OF FULL AND PARTIAL RETIREMENT FOR REPLACEMENT RATES IN A DEFINED BENEFIT SYSTEM

**Table 3.20**

Net replacement rates when the work income is €15,000

Full ret. age	Replacement rate at the indicated age										
	60	61	62	63	64	65	66	67	68	69	70
60	0.25	0.25	0.25	0.25	0.25	0.94	0.94	0.94	0.94	0.94	0.94
61	-	0.28	0.28	0.28	0.28	0.96	0.96	0.96	0.96	0.96	0.96
62	-	-	0.30	0.30	0.30	0.98	0.98	0.98	0.98	0.98	0.98
63	-	-	-	0.33	0.33	1.01	1.01	1.01	1.01	1.01	1.01
64	-	-	-	-	0.37	1.03	1.03	1.03	1.03	1.03	1.03
65	-	-	-	-	-	1.06	1.06	1.06	1.06	1.06	1.06
66	-	-	-	-	-	-	1.13	1.13	1.13	1.13	1.13
67	-	-	-	-	-	-	-	1.20	1.20	1.20	1.20
68	-	-	-	-	-	-	-	-	1.28	1.28	1.28
69	-	-	-	-	-	-	-	-	-	1.37	1.37
70	-	-	-	-	-	-	-	-	-	-	1.46
Partial ret. age											
60 (5 yrs)	0.64*	0.64*	0.64*	0.64*	0.64*	1.00	1.00	1.00	1.00	1.00	1.00
61	-	0.65*	0.65*	0.65*	0.65*	1.09*	1.05	1.05	1.05	1.05	1.05
62	-	-	0.66*	0.66*	0.66*	1.10*	1.10*	1.09	1.09	1.09	1.09
63	-	-	-	0.67*	0.67*	1.12*	1.12*	1.12*	1.15	1.15	1.15
64	-	-	-	-	0.69*	1.13*	1.13*	1.13*	1.13*	1.20	1.20
65	-	-	-	-	-	1.15*	1.15*	1.15*	1.15*	1.15*	1.27
60 (4 yrs)	0.64*	0.64*	0.64*	0.64*	0.31	0.99	0.99	0.99	0.99	0.99	0.99
61	-	0.65*	0.65*	0.65*	0.65*	1.01	1.01	1.01	1.01	1.01	1.01
62	-	-	0.66*	0.66*	0.66*	1.10*	1.06	1.06	1.06	1.06	1.06
63	-	-	-	0.67*	0.67*	1.12*	1.12*	1.10	1.10	1.10	1.10
64	-	-	-	-	0.69*	1.13*	1.13*	1.13*	1.16	1.16	1.16
65	-	-	-	-	-	1.15*	1.15*	1.15*	1.15*	1.22	1.22
60 (3 yrs)	0.64*	0.64*	0.64*	0.29	0.29	0.97	0.97	0.97	0.97	0.97	0.97
61	-	0.65*	0.65*	0.65*	0.32	1.00	1.00	1.00	1.00	1.00	1.00
62	-	-	0.66*	0.66*	0.66*	1.02	1.02	1.02	1.02	1.02	1.02
63	-	-	-	0.67*	0.67*	1.12*	1.07	1.07	1.07	1.07	1.07
64	-	-	-	-	0.69*	1.13*	1.13*	1.12	1.12	1.12	1.12
65	-	-	-	-	-	1.15*	1.15*	1.15*	1.17	1.17	1.17
60 (2 yrs)	0.64*	0.64*	0.28	0.28	0.28	1.00	1.00	1.00	1.00	1.00	1.00
61	-	0.65*	0.65*	0.31	0.31	1.02	1.02	1.02	1.02	1.02	1.02
62	-	-	0.66*	0.66*	0.34	1.04	1.04	1.04	1.04	1.04	1.04
63	-	-	-	0.67*	0.67*	1.07	1.07	1.07	1.07	1.07	1.07
64	-	-	-	-	0.69*	1.13*	1.08	1.08	1.08	1.08	1.08
65	-	-	-	-	-	1.15*	1.15*	1.13	1.13	1.13	1.13

Notes: The replacement rates with an asterisk (\*) represents those during partial retirement. The table assumes that the work income is €15,000.

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**Table 3.21**

Net replacement rates when the work income is €60,000

Full ret. age	Replacement rate at the indicated age										
	60	61	62	63	64	65	66	67	68	69	70
60	0.47	0.47	0.47	0.47	0.47	0.74	0.74	0.74	0.74	0.74	0.74
61	-	0.50	0.50	0.50	0.50	0.77	0.77	0.77	0.77	0.77	0.77
62	-	-	0.54	0.54	0.54	0.83	0.83	0.83	0.83	0.83	0.83
63	-	-	-	0.58	0.58	0.89	0.89	0.89	0.89	0.89	0.89
64	-	-	-	-	0.61	0.96	0.96	0.96	0.96	0.96	0.96
65	-	-	-	-	-	1.04	1.04	1.04	1.04	1.04	1.04
66	-	-	-	-	-	-	1.14	1.14	1.14	1.14	1.14
67	-	-	-	-	-	-	-	1.26	1.26	1.26	1.26
68	-	-	-	-	-	-	-	-	1.38	1.38	1.38
69	-	-	-	-	-	-	-	-	-	1.53	1.53
70	-	-	-	-	-	-	-	-	-	-	1.56
Partial ret. age											
60 (5 yrs)	0.73*	0.73*	0.76*	0.77*	0.79*	0.88	0.88	0.88	0.88	0.88	0.88
61	-	0.75*	0.78*	0.79*	0.81*	1.04*	0.95	0.95	0.95	0.95	0.95
62	-	-	0.80*	0.81*	0.83*	1.07*	1.07*	1.04	1.04	1.04	1.04
63	-	-	-	0.83*	0.85*	1.10*	1.10*	1.09*	1.14	1.14	1.14
64	-	-	-	-	0.88*	1.13*	1.13*	1.13*	1.13*	1.24	1.24
65	-	-	-	-	-	1.17*	1.17*	1.16*	1.16*	1.16*	1.36
60 (4 yrs)	0.73*	0.73*	0.76*	0.77*	0.55	0.84	0.84	0.84	0.84	0.84	0.84
61	-	0.75*	0.78*	0.79*	0.81*	0.90	0.90	0.90	0.90	0.90	0.90
62	-	-	0.80*	0.81*	0.83*	1.07*	0.98	0.98	0.98	0.98	0.98
63	-	-	-	0.83*	0.85*	1.10*	1.10*	1.07	1.07	1.07	1.07
64	-	-	-	-	0.88*	1.13*	1.13*	1.13*	1.17	1.17	1.17
65	-	-	-	-	-	1.17*	1.17*	1.16*	1.16*	1.28	1.28
60 (3 yrs)	0.73*	0.73*	0.76*	0.52	0.52	0.81	0.81	0.81	0.81	0.81	0.81
61	-	0.75*	0.78*	0.79*	0.56	0.86	0.86	0.86	0.86	0.86	0.86
62	-	-	0.80*	0.81*	0.83*	0.93	0.93	0.93	0.93	0.93	0.93
63	-	-	-	0.83*	0.85*	1.10*	1.02	1.02	1.02	1.02	1.02
64	-	-	-	-	0.88*	1.13*	1.13*	1.11	1.11	1.11	1.11
65	-	-	-	-	-	1.17*	1.17*	1.16*	1.21	1.21	1.21
60 (2 yrs)	0.73*	0.73*	0.50	0.50	0.50	0.78	0.78	0.78	0.78	0.78	0.78
61	-	0.75*	0.78*	0.54	0.54	0.83	0.83	0.83	0.83	0.83	0.83
62	-	-	0.80*	0.81*	0.58	0.89	0.89	0.89	0.89	0.89	0.89
63	-	-	-	0.83*	0.85*	0.97	0.97	0.97	0.97	0.97	0.97
64	-	-	-	-	0.88*	1.13*	1.05	1.05	1.05	1.05	1.05
65	-	-	-	-	-	1.17*	1.17*	1.15	1.15	1.15	1.15

Notes: The replacement rates with an asterisk (\*) represents those during partial retirement. The table assumes that the work income is €60,000. In the case of full retirement at age 70, the fiscal limit is restricting the accumulation of occupational pension rights. The replacement rate of 1.56 would have been otherwise equal to 1.69.

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Moreover, the replacement rates are lower for the lowest income earners because the amount of the tax they pay is so low that they cannot fully benefit from the flat-rate general tax credit (see Section 3.3). Second, in the case of early retirement, low income earners realize a higher replacement rate as of age 65, whereas in the case of late retirement they realize a lower replacement rate than the high income earners. However, the gap between the replacement rates across the income groups narrows around age 65. The reason for this pattern is that for low income earners the share of the occupational pension in the replacement rate is lower than that of the state pension, so that by retiring later they accumulate less occupational pension rights relative to their work income.

The comparison of the replacement rates in the lower panels of the tables reveals the following results. First, the difference between the replacement rates across income groups during the years of partial retirement is smaller than that during the corresponding years of full retirement in the upper panels of the tables. This is because, in the case of partial retirement, the replacement rate includes the share of the work income and therefore it changes in a more proportional manner with the amount of the work income. Second, the difference between the replacement rates across the income groups during the years of full retirement following partial retirement is also smaller than that during the corresponding years of full retirement in the upper panels of the tables. This is because during partial retirement employees accumulate occupational pension rights which in turn increase the replacement rate during full retirement, but the replacement rate for high income earners increases more than that for low income earners, reducing the difference between the replacement rates of the two income groups. These results therefore imply that in the case of partial retirement there is less variation in the replacement rates across the income groups than in the case of full retirement.

The preceding analysis allows for different levels of work income and analyzes the corresponding changes in the replacement rates, but it maintains the assumption that work income is constant over time. In reality, however, the age profile of work income is usually upward sloping over the life cycle (see, e.g., Murphy and Welch, 1990). In our analysis, work income affects the value of a replacement rate through the pension wealth in the numerator of the replacement rate, and through the average lifetime work income in the denominator. This means that an alternative income profile specification would affect the analysis of the level of replacement rates to the extent that either of the two effects outweighs the other. However, the analysis of the relative changes in the replacement rates across different retirement scenarios, which constitutes the core of our sensitivity analysis, would remain largely unaffected since a change in the income profile would affect the replacement rates in different retirement scenarios to similar extents. For simplicity, we retain our assumption that the income profile is flat over the life cycle.

#### **Service length**

In our baseline analysis in Table 3.18, we calculated net replacement rates under the assumption of an uninterrupted service length of 40 years. For employees with career gaps, this is an unrealistic assumption. In this subsection, we consider a service length of 20 years by the time the employee enters into full or partial retirement at age 65, and analyze its impact on the net replacement rates. Table 3.22 presents the net replacement rates. These results

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**Table 3.22**

Net replacement rates when the service length is 20 years

Full ret. age	Replacement rate at the indicated age										
	60	61	62	63	64	65	66	67	68	69	70
60	0.20	0.20	0.20	0.20	0.20	0.60	0.60	0.60	0.60	0.60	0.60
61	-	0.23	0.23	0.23	0.23	0.63	0.63	0.63	0.63	0.63	0.63
62	-	-	0.26	0.26	0.26	0.65	0.65	0.65	0.65	0.65	0.65
63	-	-	-	0.29	0.29	0.68	0.68	0.68	0.68	0.68	0.68
64	-	-	-	-	0.31	0.71	0.71	0.71	0.71	0.71	0.71
65	-	-	-	-	-	0.74	0.74	0.74	0.74	0.74	0.74
66	-	-	-	-	-	-	0.80	0.80	0.80	0.80	0.80
67	-	-	-	-	-	-	-	0.86	0.86	0.86	0.86
68	-	-	-	-	-	-	-	-	0.92	0.92	0.92
69	-	-	-	-	-	-	-	-	-	0.99	0.99
70	-	-	-	-	-	-	-	-	-	-	1.08
Partial ret. age											
60 (5 yrs)	0.66*	0.66*	0.68*	0.68*	0.69*	0.67	0.67	0.67	0.67	0.67	0.67
61	-	0.67*	0.69*	0.69*	0.70*	0.98*	0.71	0.71	0.71	0.71	0.71
62	-	-	0.70*	0.70*	0.71*	0.99*	0.99*	0.76	0.76	0.76	0.76
63	-	-	-	0.72*	0.73*	1.00*	1.00*	1.00*	0.81	0.81	0.81
64	-	-	-	-	0.74*	1.01*	1.01*	1.01*	1.01*	0.86	0.86
65	-	-	-	-	-	1.03*	1.03*	1.03*	1.03*	1.03*	0.91
60 (4 yrs)	0.66*	0.66*	0.68*	0.68*	0.26	0.66	0.66	0.66	0.66	0.66	0.66
61	-	0.67*	0.69*	0.69*	0.70*	0.68	0.68	0.68	0.68	0.68	0.68
62	-	-	0.70*	0.70*	0.71*	0.99*	0.73	0.73	0.73	0.73	0.73
63	-	-	-	0.72*	0.73*	1.00*	1.00*	0.77	0.77	0.77	0.77
64	-	-	-	-	0.74*	1.01*	1.01*	1.01*	0.82	0.82	0.82
65	-	-	-	-	-	1.03*	1.03*	1.03*	1.03*	0.87	0.87
60 (3 yrs)	0.66*	0.66*	0.68*	0.24	0.24	0.64	0.64	0.64	0.64	0.64	0.64
61	-	0.67*	0.69*	0.69*	0.28	0.67	0.67	0.67	0.67	0.67	0.67
62	-	-	0.70*	0.70*	0.71*	0.70	0.70	0.70	0.70	0.70	0.70
63	-	-	-	0.72*	0.73*	1.00*	0.74	0.74	0.74	0.74	0.74
64	-	-	-	-	0.74*	1.01*	1.01*	0.79	0.79	0.79	0.79
65	-	-	-	-	-	1.03*	1.03*	1.03*	0.84	0.84	0.84
60 (2 yrs)	0.66*	0.66*	0.23	0.23	0.23	0.65	0.65	0.65	0.65	0.65	0.65
61	-	0.67*	0.69*	0.26	0.26	0.67	0.67	0.67	0.67	0.67	0.67
62	-	-	0.70*	0.70*	0.29	0.69	0.69	0.69	0.69	0.69	0.69
63	-	-	-	0.72*	0.73*	0.72	0.72	0.72	0.72	0.72	0.72
64	-	-	-	-	0.74*	1.01*	0.76	0.76	0.76	0.76	0.76
65	-	-	-	-	-	1.03*	1.03*	0.80	0.80	0.80	0.80

Notes: The replacement rates with an asterisk (\*) represents those during partial retirement. The table assumes that the service length is 20 years.

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can be extrapolated to other changes in service length. For example, for an employee who is fully retired at age 65, the net replacement rate decreases by about 7 percentage points for each five years the employee spends less in full-time work. The decrease is less in the case of retirement at earlier ages.

The comparison of the replacement rates in the upper panels of Tables 3.22 and 3.18 reveals the following results. First, the replacement rates are lower when the service length is shorter, because employees accumulate less occupational pension rights (see Equation (3.2)). However, the employee still achieves a net replacement rate of 74% at age 65. Second, the difference between the replacement rates increases as the retirement age increases. This is because those with a shorter service length accumulate less pension rights and the actuarial increase on these rights are lower. This means that spending more years in the labor market yields a more than proportional increase in the occupational pension rights and therefore in the net replacement rates.

The main result from the comparison of the replacement rates in the lower panels of Tables 3.22 and 3.18 is the following. The difference between the replacement rates across the two groups of service length during the years of partial retirement is smaller than that during the corresponding years of full retirement in the upper panels of the tables. This is because in the case of partial retirement the retirement income includes work income and therefore depends less on the occupational pension income. Therefore, the replacement rates differ less across the individuals with different levels of occupational pension rights due to the differences in service length.

#### **Hours worked during partial retirement**

During partial retirement some employees may wish to work more hours than others. In our baseline analysis in Table 3.18, we calculated net replacement rates under the assumption of a full-time equivalent of 0.5 during partial retirement, which refers to 20 hours of work per week. In this subsection, we consider the net replacement rates for a full-time equivalent level of 0.2, or 8 hours of work per week. Our analysis shows that the replacement rates change in a proportional manner with the level of the FTE, but otherwise depend on the amounts of the employed person's tax credit and the work bonus in Table 3.14. We assume that when the employee partially retires he simultaneously defers his occupational and state pensions by the same fraction of the FTE he works during partial retirement. In fact, the fiscal law requires that the fraction of the occupational pension that the employee defers is as large as at least the fraction of the work time that he works, as discussed in Section 3.2.1. Table 3.23 presents the net replacement rates when the FTE is 0.2.

The comparison of the replacement rates in the partial retirement scenarios in Tables 3.18 and 3.23 reveals the following results. First, during partial retirement before age 65, as the number of hours worked decreases, and the claim of occupational pension rights increases, the share of work income in the replacement rate falls and the share of the occupational pension increases. As a consequence, the replacement rate is lower. The decreases in the amounts of the employed person's tax credit and the work bonus reduce the replacement rate further. During partial retirement as of age 65, the pace of the decrease in the replacement rates is smaller, because those working less claim more of their state pension. Second, during full retirement the replacement rates decrease because the employees who work less hours



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**Table 3.23**

Net replacement rates when the full-time equivalent during partial retirement is 0.2

Partial ret. age	Replacement rate at the indicated age										
	60	61	62	63	64	65	66	67	68	69	70
60 (5 yrs)	0.55*	0.55*	0.55*	0.55*	0.55*	0.86	0.86	0.86	0.86	0.86	0.86
61	-	0.58*	0.58*	0.58*	0.58*	0.97*	0.90	0.90	0.90	0.90	0.90
62	-	-	0.61*	0.61*	0.61*	1.00*	1.00*	0.94	0.94	0.94	0.94
63	-	-	-	0.64*	0.64*	1.03*	1.03*	1.03*	0.99	0.99	0.99
64	-	-	-	-	0.68*	1.07*	1.07*	1.07*	1.07*	1.05	1.05
65	-	-	-	-	-	1.11*	1.11*	1.11*	1.11*	1.11*	1.11
60 (4 yrs)	0.55*	0.55*	0.55*	0.55*	0.42	0.85	0.85	0.85	0.85	0.85	0.85
61	-	0.58*	0.58*	0.58*	0.58*	0.89	0.89	0.89	0.89	0.89	0.89
62	-	-	0.61*	0.61*	0.61*	1.00*	0.93	0.93	0.93	0.93	0.93
63	-	-	-	0.64*	0.64*	1.03*	1.03*	0.98	0.98	0.98	0.98
64	-	-	-	-	0.68*	1.07*	1.07*	1.07*	1.03	1.03	1.03
65	-	-	-	-	-	1.11*	1.11*	1.11*	1.11*	1.09	1.09
60 (3 yrs)	0.55*	0.55*	0.55*	0.42	0.42	0.84	0.84	0.84	0.84	0.84	0.84
61	-	0.58*	0.58*	0.58*	0.45	0.88	0.88	0.88	0.88	0.88	0.88
62	-	-	0.61*	0.61*	0.61*	0.91	0.91	0.91	0.91	0.91	0.91
63	-	-	-	0.64*	0.64*	1.03*	0.96	0.96	0.96	0.96	0.96
64	-	-	-	-	0.68*	1.07*	1.07*	1.01	1.01	1.01	1.01
65	-	-	-	-	-	1.11*	1.11*	1.11*	1.07	1.07	1.07
60 (2 yrs)	0.55*	0.55*	0.41	0.41	0.41	0.83	0.83	0.83	0.83	0.83	0.83
61	-	0.58*	0.58*	0.44	0.44	0.87	0.87	0.87	0.87	0.87	0.87
62	-	-	0.61*	0.61*	0.47	0.90	0.90	0.90	0.90	0.90	0.90
63	-	-	-	0.64*	0.64*	0.95	0.95	0.95	0.95	0.95	0.95
64	-	-	-	-	0.68*	1.07*	0.99	0.99	0.99	0.99	0.99
65	-	-	-	-	-	1.11*	1.11*	1.05	1.05	1.05	1.05

Notes: The replacement rates with an asterisk (\*) represents those during partial retirement. Assumptions about partial retirement as in Table 3.7: FTE during partial retirement is 0.20. Defer OP is 0.20. Defer SP is 0.20.

during partial retirement defer less of their occupational pension rights until full retirement (see Equation (3.4)) and accumulate less pension rights for full retirement (see Equation (3.6)).

#### Hours worked during the career years

Table 3.18 assumed that the employee works full time during his career years, before entering into partial or full retirement. However, Kantarcı and van Soest (2008) show that, in the last 20 years about 75% of Dutch women who were active in the labor market worked 1-34 hours a week. To allow for part-time work, we consider a case where the employee works 20 hours a week before entering into full retirement. Partial retirement seems less relevant in this case and is therefore not considered. We assume that pension rights are delayed until after retirement. Table 3.24 presents the replacement rates under these assumptions.

Comparing Tables 3.18 and 3.24 shows that, before age 65, when the retirement income

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**Table 3.24**

Net replacement rates when the full-time equivalent during the career years is 0.5

Full ret. age	Replacement rate at the indicated age										
	60	61	62	63	64	65	66	67	68	69	70
60	0.40	0.40	0.40	0.40	0.40	1.08	1.08	1.08	1.08	1.08	1.08
61	-	0.44	0.44	0.44	0.44	1.11	1.11	1.11	1.11	1.11	1.11
62	-	-	0.48	0.48	0.48	1.14	1.14	1.14	1.14	1.14	1.14
63	-	-	-	0.51	0.51	1.18	1.18	1.18	1.18	1.18	1.18
64	-	-	-	-	0.54	1.22	1.22	1.22	1.22	1.22	1.22
65	-	-	-	-	-	1.27	1.27	1.27	1.27	1.27	1.27
66	-	-	-	-	-	-	1.35	1.35	1.35	1.35	1.35
67	-	-	-	-	-	-	-	1.44	1.44	1.44	1.44
68	-	-	-	-	-	-	-	-	1.53	1.53	1.53
69	-	-	-	-	-	-	-	-	-	1.64	1.64
70	-	-	-	-	-	-	-	-	-	-	1.76

Notes: Assumptions about full retirement as in Table 3.5: FTE during partial retirement is 0.50. Defer OP is 1.00. Defer SP is 1.00. The table assumes that the full-time equivalent during the career years is 0.50.

consists of only the occupational pension, the replacement rates do not change with the full-time equivalent. This is because employees accumulate pension rights in proportion to their full-time equivalent during their career, according to Equation (3.2), but their work income also changes in proportion to their full-time equivalent. As of age 65, when employees start to receive their state pension, the replacement rates of the part-time employees are much higher. This is because their share of the state pension in the replacement rate is higher. This result shows that the income path of the part-time employees is less smooth than that of the full-time employees. An implication is that part-time employees may consider trading off higher occupational pension rights before age 65 against lower rights after age 65, as discussed in Section 3.2.1 and demonstrated in Table 3.8.

#### Domestic situation

The amounts of the occupational pension, the state pension, the flat rate health insurance premium and certain tax credits depend on the domestic situation, as explained in Sections 3.2.1, 3.2.2 and 3.3. In our baseline analysis in Table 3.18, we calculated the net replacement rates under the assumption that the employee is not single. Table 3.25 presents the replacement rates when the employee is single and has no children living with him.

The comparison of the replacement rates in the upper panels of the tables reveals the following results. First, before age 65, the replacement rates are about 7 percentage points higher if the employee is single. This is because the accumulated occupational pension rights are increased if the employee is single by the time he claims his pension rights (see Section 3.2.1), but also because he pays a lower flat rate health insurance premium and receives the elderly single person's tax credit. As of age 65, the replacement rates are about 25 percentage points higher if the employee is single. The additional increase is due to the fact that the single beneficiary receives an increased state pension as of age 65 (see Section 3.2.2). The comparison of the replacement rates in the lower panels of the tables shows that the difference between the replacement rates across the two domestic situations during the years

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**Table 3.25**

Net replacement rates when the employee is single

Full ret. age	Replacement rate at the indicated age										
	60	61	62	63	64	65	66	67	68	69	70
60	0.46	0.46	0.46	0.46	0.46	1.03	1.03	1.03	1.03	1.03	1.03
61	-	0.49	0.49	0.49	0.49	1.07	1.07	1.07	1.07	1.07	1.07
62	-	-	0.53	0.53	0.53	1.11	1.11	1.11	1.11	1.11	1.11
63	-	-	-	0.56	0.56	1.16	1.16	1.16	1.16	1.16	1.16
64	-	-	-	-	0.61	1.21	1.21	1.21	1.21	1.21	1.21
65	-	-	-	-	-	1.26	1.26	1.26	1.26	1.26	1.26
66	-	-	-	-	-	-	1.35	1.35	1.35	1.35	1.35
67	-	-	-	-	-	-	-	1.41	1.41	1.41	1.41
68	-	-	-	-	-	-	-	-	1.53	1.53	1.53
69	-	-	-	-	-	-	-	-	-	1.66	1.66
70	-	-	-	-	-	-	-	-	-	-	1.81
Partial ret. age											
60 (5 yrs)	0.78*	0.78*	0.80*	0.80*	0.81*	1.15	1.15	1.15	1.15	1.15	1.15
61	-	0.80*	0.81*	0.82*	0.83*	1.20*	1.21	1.21	1.21	1.21	1.21
62	-	-	0.83*	0.83*	0.84*	1.22*	1.22*	1.28	1.28	1.28	1.28
63	-	-	-	0.85*	0.86*	1.24*	1.24*	1.24*	1.35	1.35	1.35
64	-	-	-	-	0.88*	1.26*	1.26*	1.26*	1.26*	1.41	1.41
65	-	-	-	-	-	1.29*	1.29*	1.29*	1.29*	1.29*	1.51
60 (4 yrs)	0.78*	0.78*	0.80*	0.80*	0.53	1.12	1.12	1.12	1.12	1.12	1.12
61	-	0.80*	0.81*	0.82*	0.83*	1.17	1.17	1.17	1.17	1.17	1.17
62	-	-	0.83*	0.83*	0.84*	1.22*	1.23	1.23	1.23	1.23	1.23
63	-	-	-	0.85*	0.86*	1.24*	1.24*	1.30	1.30	1.30	1.30
64	-	-	-	-	0.88*	1.26*	1.26*	1.26*	1.38	1.38	1.38
65	-	-	-	-	-	1.29*	1.29*	1.29*	1.29*	1.44	1.44
60 (3 yrs)	0.78*	0.78*	0.80*	0.51	0.51	1.10	1.10	1.10	1.10	1.10	1.10
61	-	0.80*	0.81*	0.82*	0.55	1.14	1.14	1.14	1.14	1.14	1.14
62	-	-	0.83*	0.83*	0.84*	1.19	1.19	1.19	1.19	1.19	1.19
63	-	-	-	0.85*	0.86*	1.24*	1.25	1.25	1.25	1.25	1.25
64	-	-	-	-	0.88*	1.26*	1.26*	1.32	1.32	1.32	1.32
65	-	-	-	-	-	1.29*	1.29*	1.29*	1.37	1.37	1.37
60 (2 yrs)	0.78*	0.78*	0.49	0.49	0.49	1.07	1.07	1.07	1.07	1.07	1.07
61	-	0.80*	0.81*	0.53	0.53	1.11	1.11	1.11	1.11	1.11	1.11
62	-	-	0.83*	0.83*	0.57	1.16	1.16	1.16	1.16	1.16	1.16
63	-	-	-	0.85*	0.86*	1.21	1.21	1.21	1.21	1.21	1.21
64	-	-	-	-	0.88*	1.26*	1.28	1.28	1.28	1.28	1.28
65	-	-	-	-	-	1.29*	1.29*	1.35	1.35	1.35	1.35

Notes: The replacement rates with an asterisk (\*) represents those during partial retirement. The table assumes that the domestic situation is single.

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of partial retirement is smaller than that during the corresponding years of full retirement in the upper panels of the tables. This is because the employee claims only part of his accrued pension rights during partial retirement and hence the replacement rates increase at a lower pace. When we assume that the employee is single and has children under the age of 18 living with him, the state pension rights increase further, which further increase the replacement rates in Table 3.25. The employee also receives as additional tax credits the single parent's tax credit, single parent's supplementary tax credit and the combination tax credit, but in fact these reduce the replacement rates as of age 65 because their amounts are larger before age 65 (as was shown in Table 3.14).

#### **Pension trade-off**

Section 3.6.1 showed that before age 65 occupational pension benefits constitute the only source of retirement income and these benefits are actuarially substantially reduced for early claiming. In fact, Table 3.18 showed that before age 65 the occupational pension replaces only less than half of the preretirement earnings. This results in a large gap in retirement income when the employee starts to receive state pension benefits at age 65. To some extent the employee can avoid this gap in the following manner. Section 3.2.1 explained that the current pension system allows the employee to trade off pension rights over the retirement years. For example, the employee can claim higher occupational pension rights than he normally is eligible for during early retirement years when his pension rights are actuarially substantially reduced. This however comes at the expense of reduced pension rights at a later age. Trading off pension rights in this manner allows for smoothing the retirement income path. In Table 3.26 we consider a selection of full and partial retirement scenarios where the employee retires before age 65 and claims occupational pension rights that are 20% higher than what he normally is eligible for (baseline scenario in Table 3.18). Consequently, as of age 65 his pension rights are reduced by an amount depending on the age when additional pension rights are claimed (with respect to the age dependent actuarial factors in Table 3.9). The employee cannot claim more pension rights than the stated amount due to the fiscal constraints described in Section 3.2.1. We do not consider retirement scenarios where the employee retires at or after age 65 since the employee receives the state pension by then and would no longer be concerned about smoothing his income path.

The comparison of the replacement rates in the upper panels of Tables 3.18 and 3.26 shows that replacement rates increase by about 7 percentage points before age 65 and fall by about 2 percentage points as of age 65 due to the claim of additional pension rights before age 65. Note that pension rights are actuarially reduced due to early claiming which restricts the increase in the replacement rates before age 65. The comparison of the replacement rates in the lower panels to those in the upper panels in Tables 3.18 and 3.26 shows that the increase in the replacement rates during partial retirement is lower than that at the same ages during full retirement because only the partial occupational pension rights claimed during partial retirement are increased according to the trade-off. These results show that employees benefit from trading off their occupational pension rights since they can smooth their income path. However, the difference between the replacement rates in the case of full retirement before and after age 65 is still large in Table 3.26. This suggests that the fiscal law that restricts the amount of the pension rights that can be traded off against future

### 3. IMPLICATIONS OF FULL AND PARTIAL RETIREMENT FOR REPLACEMENT RATES IN A DEFINED BENEFIT SYSTEM

**Table 3.26**

Net replacement rates when pension rights are traded off against future rights

Full ret. age	Replacement rate at the indicated age										
	60	61	62	63	64	65	66	67	68	69	70
60	0.46	0.46	0.46	0.46	0.46	0.79	0.79	0.79	0.79	0.79	0.79
61	-	0.49	0.49	0.49	0.49	0.83	0.83	0.83	0.83	0.83	0.83
62	-	-	0.53	0.53	0.53	0.87	0.87	0.87	0.87	0.87	0.87
63	-	-	-	0.57	0.57	0.91	0.91	0.91	0.91	0.91	0.91
Partial ret. age											
60 (5 yrs)	0.78*	0.78*	0.80*	0.80*	0.81*	0.91	0.91	0.91	0.91	0.91	0.91
61 (4 yrs)	-	0.80*	0.81*	0.82*	0.83*	0.92	0.92	0.92	0.92	0.92	0.92
62 (3 yrs)	-	-	0.83*	0.83*	0.84*	0.94	0.94	0.94	0.94	0.94	0.94
63 (2 yrs)	-	-	-	0.85*	0.86*	0.97	0.97	0.97	0.97	0.97	0.97

Notes: The replacement rates with an asterisk (\*) represents those during partial retirement. The table assumes that the employee trades off occupational pension rights.

rights can be loosened for employees that meet a certain number of years of contribution so that they can better smooth their income path and still achieve a certain replacement rate at age 65.

#### Accrual rate

Goudswaard et al. (2010) indicate that two factors contribute to the increasing cost of pension benefits in the Netherlands. The first is that the return on the invested pension premiums is decreasing due to the structural decline in the interest rates, and the second is that the number of years retirees are drawing pensions is increasing due to the increasing life expectancy. The authors explain that an increase in the pension premiums paid by the employees or a decrease in the pension accrual rate can reduce the cost of pensions. They claim that there is little room for increasing the pension premiums in the Netherlands and therefore favor reducing the pension accrual rate. In fact, the accrual rate of the occupational pension in the Netherlands is among the highest among OECD countries (Whitehouse, 2006). The pension regulation in the Netherlands allows pension funds to decrease the accrual rate while keeping the premiums constant. In Table 3.27 we show how reducing the accrual rate by about 25% from its current level of 2.05% to 1.55% affects the net replacement rates.

The comparison of the replacement rates in the upper panels of Tables 3.27 and 3.18 shows that when the accrual rate is reduced the net replacement rates fall, for example, by 13 percentage points in the case of full retirement at age 65. This implies that the employee needs to work two additional years, until age 67, to reach the baseline level of replacement rate. This decrease in the accrual rate, which can be offset by working until age 67, seems to accord well with the government's plans launched in 2009 to increase the retirement age to 67 by 2025. Note however that our calculation assumes that the state pension is deferred according to the proposed state pension scheme. When we repeat our calculation under the assumption that the state pension is not deferred, the additional number of years of work

### 3. IMPLICATIONS OF FULL AND PARTIAL RETIREMENT FOR REPLACEMENT RATES IN A DEFINED BENEFIT SYSTEM

**Table 3.27**

Net replacement rates when the occupational pension accrual rate is 0.0155

Full ret. age	Replacement rate at the indicated age										
	60	61	62	63	64	65	66	67	68	69	70
60	0.33	0.33	0.33	0.33	0.33	0.73	0.73	0.73	0.73	0.73	0.73
61	-	0.35	0.35	0.35	0.35	0.76	0.76	0.76	0.76	0.76	0.76
62	-	-	0.37	0.37	0.37	0.79	0.79	0.79	0.79	0.79	0.79
63	-	-	-	0.40	0.40	0.82	0.82	0.82	0.82	0.82	0.82
64	-	-	-	-	0.42	0.85	0.85	0.85	0.85	0.85	0.85
65	-	-	-	-	-	0.89	0.89	0.89	0.89	0.89	0.89
66	-	-	-	-	-	-	0.94	0.94	0.94	0.94	0.94
67	-	-	-	-	-	-	-	1.01	1.01	1.01	1.01
68	-	-	-	-	-	-	-	-	1.08	1.08	1.08
69	-	-	-	-	-	-	-	-	-	1.16	1.16
70	-	-	-	-	-	-	-	-	-	-	1.26
Partial ret. age											
60 (5 yrs)	0.72*	0.72*	0.73*	0.74*	0.75*	0.81	0.81	0.81	0.81	0.81	0.81
61	-	0.73*	0.74*	0.75*	0.76*	1.04*	0.85	0.85	0.85	0.85	0.85
62	-	-	0.76*	0.76*	0.77*	1.05*	1.05*	0.90	0.90	0.90	0.90
63	-	-	-	0.78*	0.78*	1.06*	1.06*	1.06*	0.95	0.95	0.95
64	-	-	-	-	0.80*	1.08*	1.08*	1.08*	1.08*	1.01	1.01
65	-	-	-	-	-	1.10*	1.10*	1.09*	1.09*	1.09*	1.07
60 (4 yrs)	0.72*	0.72*	0.73*	0.74*	0.37	0.79	0.79	0.79	0.79	0.79	0.79
61	-	0.73*	0.74*	0.75*	0.76*	0.82	0.82	0.82	0.82	0.82	0.82
62	-	-	0.76*	0.76*	0.77*	1.05*	0.87	0.87	0.87	0.87	0.87
63	-	-	-	0.78*	0.78*	1.06*	1.06*	0.91	0.91	0.91	0.91
64	-	-	-	-	0.80*	1.08*	1.08*	1.08*	0.97	0.97	0.97
65	-	-	-	-	-	1.10*	1.10*	1.09*	1.09*	1.02	1.02
60 (3 yrs)	0.72*	0.72*	0.73*	0.36	0.36	0.78	0.78	0.78	0.78	0.78	0.78
61	-	0.73*	0.74*	0.75*	0.39	0.81	0.81	0.81	0.81	0.81	0.81
62	-	-	0.76*	0.76*	0.77*	0.84	0.84	0.84	0.84	0.84	0.84
63	-	-	-	0.78*	0.78*	1.06*	0.88	0.88	0.88	0.88	0.88
64	-	-	-	-	0.80*	1.08*	1.08*	0.93	0.93	0.93	0.93
65	-	-	-	-	-	1.10*	1.10*	1.09*	0.98	0.98	0.98
60 (2 yrs)	0.72*	0.72*	0.35	0.35	0.35	0.76	0.76	0.76	0.76	0.76	0.76
61	-	0.73*	0.74*	0.37	0.37	0.79	0.79	0.79	0.79	0.79	0.79
62	-	-	0.76*	0.76*	0.40	0.82	0.82	0.82	0.82	0.82	0.82
63	-	-	-	0.78*	0.78*	0.85	0.85	0.85	0.85	0.85	0.85
64	-	-	-	-	0.80*	1.08*	0.90	0.90	0.90	0.90	0.90
65	-	-	-	-	-	1.10*	1.10*	0.95	0.95	0.95	0.95

Notes: The replacement rates with an asterisk (\*) represents those during partial retirement. The table assumes that the occupational pension accrual rate is 0.0155.

### 3. IMPLICATIONS OF FULL AND PARTIAL RETIREMENT FOR REPLACEMENT RATES IN A DEFINED BENEFIT SYSTEM

**Table 3.28**

Net replacement rates when there is no work bonus

Full ret. age	Replacement rate at the indicated age										
	60	61	62	63	64	65	66	67	68	69	70
68	0.00	0.00	0.06	0.08	0.11	0.02	0.02	0.01	1.26	1.26	1.26
Partial ret. age											
60 (5 yrs)	0.76*	0.76*	0.76*	0.76*	0.76*	0.92	0.92	0.92	0.92	0.92	0.92
61	-	0.77*	0.77*	0.77*	0.77*	1.07*	0.97	0.97	0.97	0.97	0.97
62	-	-	0.78*	0.78*	0.78*	1.09*	1.09*	1.03	1.03	1.03	1.03
63	-	-	-	0.80*	0.80*	1.11*	1.11*	1.11*	1.09	1.09	1.09
64	-	-	-	-	0.81*	1.13*	1.13*	1.13*	1.13*	1.16	1.16
65	-	-	-	-	-	1.16*	1.16*	1.16*	1.16*	1.16*	1.25

Notes: The replacement rates with an asterisk (\*) represents those during partial retirement. The table assumes that there is no work bonus. The table assumes that the state pension is deferred fully and partially.

required to offset the decrease in the accrual rate increases to almost three years. The table shows that the offsetting number of years of work also increases with retirement at earlier ages, since the rate of the actuarial increase in the pension rights for delaying retirement is lower at those ages. In the case of partial retirement, during the partial retirement years, the decrease in the replacement rates is lower, because the replacement rate is proportional to the earned income, but in the years of full retirement, the reduction is about the same as in the case of full retirement.

#### Work bonus

Section 3.3 introduced the tax credits we have accounted for in our calculation of net income. One of these tax credits is the work bonus, introduced in January 2009 to encourage older workers to work beyond age 62. The tax credit varies by age and people receive it from age 62 to age 67 if they earn a certain amount of labor income during these years (see Table 3.14). Policy makers are currently discussing whether the work bonus is an effective tool to improve the labor market participation among older workers. For example, Sap et al. (2009) argues that since low educated employees leave the labor market much earlier than highly educated employees, the work bonus would mainly apply to the latter group. However, since this group includes mostly high income earners, they would be less likely to be sensitive to the work bonus as a financial incentive.

In the current analysis we study the impact of abolishing the work bonus on the net replacement rate of the average income earner. Table 3.28 shows a selection of full and partial retirement scenarios. The upper panel of the table shows that during the period when the employee is working full-time, his work income is 6, 8, 11, 2, 2 and 1 percentage points lower than if the work bonus is not abolished, at the corresponding ages from 62 to 67. The lower panel of the table shows that during the five year period when the employee is working part-time, the replacement rates are 1, 2, 3, 1, 1 and 0 percentage points lower than if the work bonus is not abolished. These results show that abolishing the work bonus would result in a fairly substantial loss of income in the case of full-time work at ages 62,

### 3. IMPLICATIONS OF FULL AND PARTIAL RETIREMENT FOR REPLACEMENT RATES IN A DEFINED BENEFIT SYSTEM

63 and 64, but a less than proportional loss of income in the case of part-time work. This is because the work bonus only applies to work income exceeding a fixed amount of €9,042 (see Table 3.14), so that part-time workers benefit less relative to their work income.

## 3.7 Conclusion

Increasing life expectancy implies that the number of years retirees claim pensions increases, which raises concerns for the financing of these pensions. In fact, recent austerity measures taken to guarantee the sustainability of the pension system in the Netherlands aim at increasing the effective retirement age so that the number of years retirees draw pensions decreases. We studied full and partial retirement scenarios where employees delay their occupational and state pension claims beyond the statutory retirement age, and showed how this affects the net retirement income relative to the previous earnings. We also studied full and partial retirement before the statutory retirement age since in the Netherlands many employees retire early. We showed that by working part-time after the statutory retirement age, individuals can rely on their work income instead of their pensions only and at the same time continue to accrue pension rights. This implies a more self-reliant financial security in retirement.

Increasing life expectancy may also imply extended work lives. For an increasing population of older workers working in different occupations involving different levels of physical or mental activity, it is essential to provide varied retirement path options. We demonstrated a rich set of income paths in full and partial retirement scenarios. We paid particular attention to partial retirement since older workers might prefer to continue to work at a reduced work effort. In Section 3.1, we argued that older workers in search of partial retirement opportunities are restricted by labor market rigidities. Our analysis shows that the current pension system in the Netherlands provides ample opportunities for partial retirement. This implies that the labor market restrictions that might be preventing employees to take up a partial retirement arrangement in the Netherlands shall be originating from other causes than the pension system.

The main results of the paper are the following. Our analysis of the occupational pension shows that partial retirement during the years surrounding age 65 provides an actuarially neutral alternative to full retirement at age 65. The analysis of the state pension shows that the financial gain for the individual, or the loss for the government, when the state pension is deferred beyond age 65 is rather limited. The principal result of the baseline analysis of the replacement rates is that partial retirement instead of full retirement results in a much smoother income path before age 65 and encourages employees to defer their pension rights beyond age 65. The sensitivity analysis shows first of all that the replacement rates differ substantially across the employees with different levels of work income in the cases of early and late full retirement. These changes are much less substantial in the case of partial retirement. This is also true for the changes in the service length, domestic situation, and the occupational pension accrual rate. Second, the government's current plan of increasing the retirement age to 67 allows for about a 25% decrease in the current accrual rate of the occupational pension rights while the financial well being of a retiree at age 67 remains the same as that of a retiree at age 65 if the retirement age is not increased.



### 3. IMPLICATIONS OF FULL AND PARTIAL RETIREMENT FOR REPLACEMENT RATES IN A DEFINED BENEFIT SYSTEM

From a policy point of view, perhaps the most interesting results are those comparing the replacement rates for different levels of pre-retirement earnings, keeping other variables constant such as the number of years of pension contributions at each given age. Differences are due to state pensions playing a larger role for the lower income groups, and taxes and benefits with different implications before and after retirement. For the baseline scenario of full retirement at age 65, the net replacement rates are 106, 102 and 104 percent for low, median, and high income levels (€15,000, €30,000 and €60,000). Late retirement (age 70) is financially attractive for everyone, but more so for the higher income group whose replacement rate would change from 104 to 156 than for the lower and medium income groups, whose replacement rates would change from 106 to 146 and from 102 to 140, respectively. This shows that the current system with flexible and actuarially fair occupational pensions unintentionally has a larger incentive to retire later for the highest income groups (even keeping the number of years employees have contributed to the pension fund constant).

Similarly, we can compare the incentives of the three income groups to retire partially and work half time from age 65 to age 70. For the median income group, this gives replacement rates 116 and 125 during partial and full retirement corresponding to a weighted (lifetime after 65) average of about 122 (Table 3.8), an increase of 20 percentage points compared to the baseline (102 for full retirement at age 65). For the lower income group, the replacement rates are 115 and 127 for a life time average of about 123, coming from a baseline of 106, so that this partial retirement scenario seems relatively less attractive for the low incomes. For the high income group the replacement rates are 117 and 136 during partial and full retirement for a life time average of about 130, compared to 104 at baseline, giving them a clearly larger advantage than both other groups. More flexibility and actuarial neutrality of occupational pensions will therefore benefit the higher income groups more than the lower incomes when other features of the institutions driving replacement rates in terms of disposable income are taken into account.

In this paper we assumed a given amount of work income and working career for a hypothetical worker. We calculated his replacement rate in full and partial retirement scenarios and analyzed how it changes with respect to the parameters of the underlying pension system and worker characteristics in a deterministic manner. In future research we will conduct similar analysis on replacement rates using data on actual workers. Data on labor income and pension entitlements is available from the biggest pension funds in the Netherlands. This analysis will allow us to identify the variation in replacement rates in the population and its possible determinants. We will then be able to compare the variation in the replacement rates in the population to the variation predicted in a deterministic manner in the current paper. We will also be able to carry out interesting policy simulations. For example, we will analyze the effect of life expectancy on replacement rates while we will allow life expectancy to vary with the earnings level at the same time.

## 4 Stated preference analysis of full and partial retirement in the United States

In the traditional retirement scenario, individuals work full-time until a given age and then stop working abruptly. In the alternative partial retirement scenario, individuals work part-time for several years before they stop working. For the individual, partial retirement provides a smooth transition to full-retirement where they gradually adjust to a possibly lower income and more leisure time in full-retirement, and for the economy, it is a potential policy tool to keep people employed longer. The models developed to explain the retirement decisions of older workers are typically estimated using data on actual retirement behavior, from which it is difficult to identify the retirement options available to employees. In particular, employers often do not provide partial retirement opportunities. In this study, we use stated preference data to identify the preferences of individuals for full and partial retirement plans. We consider a choice set of hypothetical full and partial retirement plans and ask the respondents of a survey representative for the US population of ages 40 and over to choose their favorite plan. We analyze how the choices vary with financial incentives and other factors.

### 4.1 Introduction

In the traditional retirement scenario, individuals work full-time until a given age and then stop working abruptly, also referred to as “cliff-edge” retirement. Several studies suggest that for many employees this retirement pattern is a result of labor market rigidities that limit the opportunities of employees to reduce their hours in a gradual manner before they leave the labor market (Quinn, 1981; Hurd, 1996; Mayer and Müller, 1986). For example, quasi-fixed employment costs discourage employers to permit part-time work (Hurd, 1996). In jobs where members of a team need to interact in the same place at the same time, part-time employment will be difficult (Latulippe and Turner, 2000; Hutchens, 2010). Employers may favor younger workers over older workers, due to age discrimination or for some other reason, and not offer partial retirement. In the United States, the social security regulation requires that the retirement benefits are reduced for people who are below the retirement age and have earnings above an exempt amount, discouraging employees to work reduced hours and draw pension benefits at the same time.

In a partial retirement scenario, as an alternative to an abrupt full-retirement scenario, employees phase out from the labor market by reducing their work hours or by changing to a less demanding job with usually lower earnings.<sup>17</sup>

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<sup>17</sup>Following Gustman and Steinmeier (1984a), some of the subject studies use the term partial retirement to refer to reducing work effort outside of the career job, and phased retirement to refer to reducing work effort within the career job. Other studies use the term gradual retirement to describe work effort reduction in general. Although in our analysis we sometimes differentiate between phased and partial retirement with

#### 4. STATED PREFERENCE ANALYSIS OF FULL AND PARTIAL RETIREMENT IN THE UNITED STATES

Partial retirement programs may be expected to become more common in the future, perhaps also after age 65, for at least the following reasons. First, many employees state an interest in working part-time before retirement. In a US Internet survey in 2005, 38% of the respondents ages 50 and older who were currently working stated interest in participating in partial retirement (Brown, 2005). In the first three waves (1992-1996) of the Health and Retirement Study (HRS), Graig and Paganelli (2000) find that three out of four older workers prefer to reduce their work hours gradually rather than retire abruptly. Siegenthaler and Brenner (2000) report similar figures from other US surveys. Second, partial retirement allows employees to gradually adjust to a possibly lower income in retirement by combining part-time work income with a partial pension, especially in the case of early retirement when benefits are reduced substantially due to early claiming. Third, working part-time during the otherwise full retirement years may help to limit the loss of cognitive skills (Rohwedder and Willis, 2010; Bonsang et al., 2012). For the employer, partial retirement provides an opportunity to retain people with precious skills that are difficult to replace (Laczko, 1988; Olmsted and Smith, 1994; Latulippe and Turner, 2000; Ghent et al., 2001; Munzenmaier and Paciero, 2002). For the macro-economy, partial retirement may extend the employment years by facilitating work after the effective retirement age or by restraining early withdrawal from the labor market, and sustain the pension system by extending the contribution periods and reducing the number of years during which full benefits are claimed (Wadensjö, 2006). This also seems to be the main reason why many countries are currently considering ways to remove impediments to partial retirement, as part of a package of policy measures to increase retirement flexibility (see, e.g., Shultz and Henkens (2010) and other studies in the same special issue). On the other hand, stimulating partial retirement may of course also have the reverse effect of reducing total labor supply, if workers use partial retirement as an alternative to full-time work rather than full-time retirement.

The economic literature explains the labor supply behavior of older workers in a life cycle framework, where workers choose the optimal combination of work, leisure, income and consumption, taking account of the future by maximizing expected utility over the life cycle (Lazear, 1987; Hurd, 1990; Lumsdaine and Mitchell, 1999). The models developed to explain the retirement decisions of older workers are typically estimated using data on actual retirement decisions (Stock and Wise, 1990; Rust and Phelan, 1997). From such data, however, it is difficult to identify the retirement options available to employees because features of the options that are not chosen are typically not completely observed, or because it is not even clear which options could have been chosen. This is a particular problem for partial retirement plans, since it is often unclear whether an employer offers such a plan, and, if there is a plan, which trajectory of earnings and pension incomes it implies. For example, Hutchens (2010) indicates that partial retirement arrangements are often informal agreements negotiated between an employee and employer. A comparison of the stated and revealed preferences for partial retirement plans suggests that many workers are interested but have limited or no access to partial retirement. US surveys find that 38% to 60% of the respondents have an interest to participate in partial retirement (Brown, 2005; Roper Starch Worldwide, 2004; Watson Wyatt Worldwide, 2004). On the other hand, studies based on

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respect to employer change, we also use partial retirement as a generic term to differentiate it from full retirement.

#### 4. STATED PREFERENCE ANALYSIS OF FULL AND PARTIAL RETIREMENT IN THE UNITED STATES

the HRS find that only 15% to 25% participate in partial retirement or some form of it (Gustman and Steinmeier, 2000a; Scott, 2004; Cahill et al., 2006).

To avoid these problems, our analysis is based upon stated preference data. As stated by Louviere et al. (2000), stated preference data can capture a wider and broader array of preference-driven behaviors than data on actual behavior, allowing for experiments with choice opportunities that do not yet exist in the market. This is precisely the approach we take in this study. We analyze retirement plans that do not yet exist, or for which we do not know whether workers have access to them. We present the respondents of an Internet panel survey representative for the adult US population with a choice set of hypothetical full and partial retirement plans of hypothetical people, irrespective of whether their own employer actually offers partial retirement. The hypothetical plans focus on the trade-off between working more hours or more years with a higher pension level versus working less with a lower pension. The labor market states considered are working full-time, working part-time with a partial pension, and full retirement; alternative exit routes such as unemployment or disability do not play a role in the scenarios and are not analyzed in this study. Each retirement plan has its own earnings and pension income trajectory. Respondents make leisure versus income trade-offs to choose their favorite plan and also indicate how attractive they find each plan.

These data are ultimately intended to be used in a structural life-cycle model, in which life time utility is a discounted sum of within period utilities driven by consumption expenditures and leisure. On the basis of such a model, it will also be possible to forecast choices among scenarios that are not asked in the stated preference questions, with, for example, different part-time factors or longer or shorter periods of part-time work. The current paper, however, is a more modest first step: it aims at describing part of the stated preferences experiment and the data, and uses some standard models to analyze how the choices between scenarios vary with scenario characteristics. We analyze the plan choices in a multinomial logit model where choices depend on economic variables, such as replacement rates, job characteristics, and job satisfaction, but also on personal characteristics like health and household size.

This paper proceeds as follows. Section 5.2 describes the experimental design. Section 4.3 presents descriptive statistics on the stated preferences for full and partial retirement plans. Section 5.5 describes the econometric model. Section 4.5 presents the results. Section 5.6 discusses some policy implications.

## 4.2 Data and experimental design

We fielded our survey in 2010 in the American Life Panel, an Internet panel of respondents 18 and over maintained by the RAND Cooperation. Selected respondents are representative of the total population, but the sample is relatively highly educated due to the high nonresponse rate of the less educated respondents. Respondents either use their own computer to log on to the Internet or they were provided a small laptop or a Web TV, which allows them to access the Internet and participate in the surveys. Respondents are interviewed twice a month and are paid an incentive of about \$20 per thirty minutes of interviewing. We restricted our sample to the respondents ages 40 and older which generated 2028 responses.

#### 4. STATED PREFERENCE ANALYSIS OF FULL AND PARTIAL RETIREMENT IN THE UNITED STATES

**Table 4.1**

Background characteristics

Characteristic	Attribute	Percentage
Age	40-49	26.9
	50-59	36.7
	60-69	24.2
	70+	12.2
Gender	Female	57.7
	Male	42.3
Marital status	Living with a partner	66.4
	Single (divorced, widowed, etc.)	33.6
Health status	Not limited	71.8
	Limited but not severely	21.9
	Severely limited	6.3
Education level	Lower than high school degree	2.5
	High school degree	16.7
	Some college but no degree	24.8
	Associate degree in college	13.1
	Bachelors degree	23.5
	Higher than bachelors degree	19.5
Work status	Working for an employer	50.7
	Working self-employed	9.4
	Retired	22.1
	Other	17.8
Income level	\$0-999	16.9
	\$1000-1999	20.6
	\$2000-2999	20.2
	\$3000-3999	13.5
	\$4000-4999	9.5
	\$5000+	19.3

Notes: Number of observations is about 2000. Income levels represent self-reported last monthly income from work, after taxes and other deductions. Totals may not add due to rounding error.

Table 4.1 presents summary statistics on background characteristics.

The survey consisted of two main parts. The first part included questions on background characteristics and several aspects of work and social life. The questions in the second part aimed at measuring preferences for abrupt and partial retirement scenarios. We also asked questions on the factors that could limit respondents to participate in partial retirement. These questions are out of the scope of this paper and are analyzed in a separate paper. Details on the survey questions can be found at <https://sites.google.com/site/tungakantarci/home/research>.

Figures 4.1 through 4.4 in the Appendix show the questions on preferences for retirement scenarios as they appeared on the screens of the respondents. The questions aim to elicit preferences on several aspects of partial retirement, including duration and starting age of partial retirement, and whether partial retirement involved changing jobs or not. In this paper we analyze only the question presented in Figure 4.1. The question starts with an introductory text explaining the topic and then describes three retirement scenarios. Each scenario is described by means of a short text followed by a timeline showing the number

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of hours worked and the amounts of work and retirement income earned by a hypothetical employee at the corresponding ages on the timeline. Respondents are asked to choose their favorite retirement scenario, and in the follow-up screen they are asked to rate each scenario on a 10 point scale where 1 denotes “not interesting at all” and 10 denotes “perfect”. Prior to the question, an instructions page is presented where the layout of the retirement scenarios is described in detail.

The retirement scenarios take the form of a vignette. A vignette is a short description of a hypothetical situation. Vignettes have been used for a long time in the social sciences and more recently also in economics. See for an early example van Beek et al. (1997). Our vignettes are short descriptions of hypothetical retirement scenarios of hypothetical people. The main reason for using vignettes with hypothetical people is that respondents for whom some of the retirement scenarios seem rather unrealistic in their actual situation can still answer the questions. For example, the long-term unemployed may get upset and not respond if we ask them to imagine they have a permanent job until retirement age, but will take it less personal if we describe a hypothetical person and ask them to evaluate this person’s retirement plan from the point of view of their own preferences.

Each of the retirement scenarios we present is characterized by four attributes: age of retirement, number of hours worked, work income, and retirement income. The age at which the employee retires is fictitious, that is, completely independent of the respondent’s own employment situation, age, or other characteristics. The number of hours worked is also fictitious where we assume that the employee works 40 hours a week during full-time work and 20 hours a week during partial retirement.<sup>18</sup>

The work income and retirement income take realistic values considering the respondent’s own employment situation. Work income in the vignette questions is based upon the actual work income of the respondent, footnoteThis is done to avoid the alienation bias that might arise if respondents have problems evaluating choices that are too far from their own situation (Hanemann, 1994; Whittington, 2002). which is asked in an earlier categorical question on their last monthly income from work. The retirement income is computed as a percentage of work income, starting from a given replacement rate. In the scenarios as they are presented to the respondents, however, retirement income and work income are shown in absolute amounts and the replacement rates are not shown. The replacement rates are based upon the typical replacement rates in the Netherlands computed by Kantarcı et al. (2011), since, due to the defined contribution nature of most US occupational pensions, such calculations cannot be done for the US. To account for the fact that net replacement rates in the Netherlands are higher than in the US (OECD, 2009), we scaled down the net replacement rates calculated in the Netherlands so that the average US level is obtained.<sup>19</sup>. In our hypothetical scenarios, the replacement rate increases by an average of 8% for each year full retirement is delayed, which is the same as the reward in the US for delaying Old Age Social Insurance benefits.

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<sup>18</sup>Chen et al. (2006) showed that the average full-time worker in the US in 2002 worked on average about 45 hours a week and the average partial retiree worked about 27 hours a week.

<sup>19</sup>For example, in the case of abrupt retirement at age 65, we reduce the net replacement rate from 102% to 70% which is approximately the net replacement rate of an American worker with average earnings participating in the public pension scheme as well as in a voluntary defined benefit pension scheme (OECD, 2009, pp. 119-121)

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We randomized the following three attributes of the vignette scenarios: the retirement age, the retirement income, and the wage rate during partial retirement.<sup>20</sup>

For the retirement age, we randomly assign one of three regimes, denoted as 65, 63, and 61. Each regime defines particular ages of partial and full retirement in the three retirement scenarios that a respondent is asked to compare; see Table 4.2. For example, for regime 65, in the first (abrupt) retirement scenario the full retirement age is 65, in the second (abrupt) scenario the full retirement age is 70, and in the third (gradual retirement) scenario the partial retirement age is 65 and the full retirement age is 70. Randomization in the retirement age aims to create variation in the scenario choices with respect to the timing of retirement.<sup>21</sup>

For the second attribute, retirement income (or replacement rate), we randomly assign one of nine regimes, where each regime is characterized by low, middle or high replacement rates in all three scenarios and by low, middle, or high rewards for retiring later. The variation in the level of the replacement rates, irrespective of the retirement age, is used to estimate the *income effect* of retirement income on the retirement decision. If leisure is a normal good, we expect that higher replacement rates lead to less labor supply and therefore to earlier full retirement, or partial retirement instead of late abrupt retirement. We refer to this randomized regime allocation as the “income effect” regime. The variation in the rewards for retiring later changes the price of leisure and can therefore be used to estimate a *substitution effect*. This regime choice is therefore referred to as the “substitution effect regime”. The middle substitution effect regime gives approximately actuarially fair rewards for later retirement (and actuarially fair penalties for early retirement). In other words, the changes in the expected net present value of total retirement income are approximately equal to the net present value of the additional premiums that are paid. The “high substitution effect regime” gives more than actuarially fair rewards for later retirement, or positive “accruals”. The “low substitution effect regime” gives less than actuarially fair rewards for later retirement (negative accruals).

Table 4.2 presents the replacement rates for the nine regimes, the combinations of the three income and the three substitution effect regimes. The first, second and third row always indicates a low, middle or high substitution, and the first, second and third column correspond to the low, middle, or high income. For example, the group low (accruals)/low (income) with retirement age regime 65 has replacement rates 60% for early retirement, 90% for late retirement, and (as of age 70) 75% for partial retirement. For the group high (accruals)/low (income), the replacement rates are 60%, 110% and 85%, respectively. The group high/low therefore gets a much higher reward for retiring later, or, in other words, pays a higher price for more leisure (in the form of retiring early). We therefore expect that this group substitutes expensive leisure for relatively cheap consumption and in analogy to the labor supply literature, we refer to the difference between choices in the first row and the third row as the (uncompensated) substitution effect.<sup>22</sup> On the other hand, if we compare

<sup>20</sup>Moreover, we randomized the order in which the scenarios were presented.

<sup>21</sup>One might argue that it would also be interesting to compare the partial retirement scenario in this example with abrupt retirement at age 67 or 68. This is not done in our questions, but, exploiting the variation in retirement ages, such a comparison could be made with a structural model estimated using these data.

<sup>22</sup>The substitution effect can be compared to the *price effect* of pension benefits in, e.g., Euwals et al.

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**Table 4.2**

Competing retirement scenarios and associated replacement rates

Retirement scenario	Retirement age regime	Ret. age	Rep. rate during PR	Rep. rate during FR
FR	65	65		0.60/0.70/0.80 0.60/0.70/0.80 0.60/0.70/0.80
FR				0.90/1.00/1.10 1.00/1.10/1.20 1.10/1.20/1.30
PR			0.20/0.30/0.40 0.25/0.35/0.45 0.30/0.40/0.50	0.75/0.85/0.95 0.80/0.90/1.00 0.85/0.95/1.05
FR		63		0.50/0.60/0.70 0.50/0.60/0.70 0.50/0.60/0.70
FR				0.70/0.80/0.90 0.80/0.90/1.00 0.90/1.00/1.10
PR			0.15/0.25/0.35 0.20/0.30/0.40 0.25/0.35/0.45	0.60/0.70/0.80 0.65/0.75/0.85 0.70/0.80/0.90
FR	61	61		0.40/0.50/0.60 0.40/0.50/0.60 0.40/0.50/0.60
FR				0.50/0.60/0.70 0.60/0.70/0.80 0.70/0.80/0.90
PR			0.10/0.20/0.30 0.15/0.25/0.35 0.20/0.30/0.40	0.45/0.55/0.65 0.50/0.60/0.70 0.55/0.65/0.75

Notes: 1. FR and PR denotes full and partial retirement, respectively. 2. Looking at the replacement rates row-wise, the first, second and third rows refer, respectively, to the low, middle and high substitution effect regimes. Looking at the replacement rates column-wise, the first, second and third columns refer, respectively, to the low, middle and high income effect regimes.



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the replacement rates for the group low/low with those of the group low/high (first row, last column: 80%, 110%, 95%), the compensation (in %-points) for retiring later (the “price of leisure”) is the same, but the pension income levels are much higher for the low/high group. Following the labor supply literature, we refer to the difference between the choices of low/high and low/low group as an income effect.<sup>23</sup>

The levels of the replacement rates associated with a particular retirement income regime depend on the retirement age regime in two respects. First, the replacement rates decrease through earlier retirement age regimes 63 and 61 because pension benefits are actuarially adjusted for earlier claiming and because those who retire earlier accumulate less pension rights. Second, at the earlier retirement age regimes, the increase in the replacement rates for delaying retirement is smaller because the actuarial increase for delaying benefits is smaller at earlier retirement ages (due to the fact that life expectancy is longer at earlier ages).

For the third attribute, wage rate in partial retirement, we define two regimes. Several studies showed that labor market rigidities force employees to partially retire outside their main job where they work at a lower wage rate (Gordon and Blinder, 1980; Gustman and Steinmeier, 1984b, 1985; Ruhm, 1990; Latulippe and Turner, 2000). We aim to investigate how respondents evaluate partial retirement when it is associated with a reduced wage rate or not. In the first regime the employee reduces hours in the same job and for the same wage rate (*phased retirement*), while in the second regime he reduces his hours by changing to a different job with a wage rate that is 10 percent lower than the wage rate at the old job (*partial retirement*, in the narrow definition; see Section 1).

### 4.3 Descriptive results

Respondents were first asked to choose among three scenarios of early abrupt retirement, late abrupt retirement and partial retirement, and were then asked to rate each scenario on a 10 point scale. Overall, merging all regimes, 21.7% chose the early abrupt retirement scenario, 37.1% the late abrupt retirement scenario, and 41.3% the partial retirement scenario. The figure for partial retirement compares to results in other US surveys, indicating that between 38% and 60% have an interest to participate in partial retirement (Brown, 2005; Roper Starch Worldwide, 2004; Watson Wyatt Worldwide, 2004). The retirement scenarios are respectively rated 5.1, 5.8 and 6.3 on average (with statistically significant differences). To check if respondents consistently tend to rate the retirement scenario they chose in the first question higher than the other two retirement scenarios, we calculate the average ratings given to each scenario conditional on choice. We find average ratings for early abrupt retirement, late abrupt retirement, and partial retirement of 7.7, 3.8, and 5.0 for those who choose early abrupt retirement; 3.9, 7.9, 5.5 for those who choose late abrupt retirement; and 4.7, 4.9, and 7.8 for those who choose partial retirement. These figures show that, on average, respondents give the highest rating to the retirement scenario of their choice, suggesting that, on average, respondents are consistent in their answers. Table 4.3 shows the percentage of

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(2010).

<sup>23</sup>The income effect can be compared to the *wealth effect* of pension benefits in, e.g., Euwals et al. (2010).

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**Table 4.3**  
Percentage of choices and average ratings under the substitution and income effect regimes

Retirement scenario	Retirement regime	Ret. age	Retirement income, substitution effect regime		Choice (%)	Rating (avg.)	Retirement income, income effect regime		Choice (%)	Rating (avg.)
			Regime	Rep. rates			Regime	Rep. rates		
FR	65	65	L	0.60/0.70/0.80	30.8	5.6	L	0.60/0.60/0.60	23.0	5.1**
FR	70	70		0.90/1.00/1.10	29.3	5.4		0.90/1.00/1.10	29.9	5.2
PR	65-69	65-69		0.75/0.85/0.95	39.9	6.4***		0.75/0.80/0.85	47.1	6.3***
FR	65	65	M	0.60/0.70/0.80	26.7	5.4	M	0.70/0.70/0.70	27.8	5.5
FR	70	70		1.00/1.10/1.20	29.0	5.3		1.00/1.10/1.20	30.0	5.5
PR	65-69	65-69		0.80/0.90/1.00	44.3	6.3***		0.85/0.90/0.95	42.2	6.4***
FR	65	65	H	0.60/0.70/0.80	25.8	5.2*	H	0.80/0.80/0.80	32.3	5.5
FR	70	70		1.10/1.20/1.30	29.7	5.4		1.10/1.20/1.30	27.9	5.3
PR	65-69	65-69		0.85/0.95/1.05	44.5	6.3***		0.95/1.00/1.05	39.7	6.3***
FR	63	63	L	0.50/0.60/0.70	23.3	5.6	L	0.50/0.50/0.50	15.1	4.8***
FR	68	68		0.70/0.80/0.90	32.0	5.5		0.70/0.80/0.90	44.0	5.8*
PR	63-67	63-67		0.60/0.70/0.80	44.7	6.4***		0.60/0.65/0.70	40.9	6.4***
FR	63	63	M	0.50/0.60/0.70	21.5	5.0***	M	0.60/0.60/0.60	20.6	4.8***
FR	68	68		0.80/0.90/1.00	39.3	5.8**		0.80/0.90/1.00	38.5	5.8
PR	63-67	63-67		0.65/0.75/0.85	39.3	6.4***		0.70/0.75/0.80	40.8	6.2***
FR	63	63	H	0.50/0.60/0.70	21.1	4.7***	H	0.70/0.70/0.70	30.4	5.6
FR	68	68		0.90/1.00/1.10	37.6	5.8		0.90/1.00/1.10	26.6	5.6
PR	63-67	63-67		0.70/0.80/0.90	41.3	6.3***		0.80/0.85/0.90	43.0	6.4***
FR	61	61	L	0.40/0.50/0.60	19.1	5.3	L	0.40/0.40/0.40	11.3	4.4***
FR	66	66		0.50/0.60/0.70	39.6	5.9**		0.50/0.60/0.70	49.4	6.4***
PR	61-65	61-65		0.45/0.55/0.65	41.2	6.4***		0.45/0.50/0.55	39.3	6.3***
FR	61	61	M	0.40/0.50/0.60	17.7	4.6***	M	0.50/0.50/0.50	16.4	4.8***
FR	66	66		0.60/0.70/0.80	44.3	6.0***		0.60/0.70/0.80	45.6	6.3***
PR	61-65	61-65		0.50/0.60/0.70	37.9	6.3***		0.55/0.60/0.65	38.0	6.3***
FR	61	61	H	0.40/0.50/0.60	10.5	4.3***	H	0.60/0.60/0.60	20.6	5.1**
FR	66	66		0.70/0.80/0.90	50.2	6.6***		0.70/0.80/0.90	38.1	5.7
PR	61-65	61-65		0.55/0.65/0.75	39.3	6.4***		0.65/0.70/0.75	41.3	6.4***

Notes: FR and PR denotes full and partial retirement, respectively. L, M and H respectively refer to low, middle and high regimes. In the table, for the partial retirement scenario, the replacement rates during the period of partial retirement are not shown but only those during full retirement. About 200 respondents choose one of the three retirement plans and rate each of them under each regime of the substitution and income effects, under each age regime. Totals of choices may not add due to rounding error. 1, 2 and 3 asterisks denote significance respectively at 10%, 5% and 1% based on the test of the null hypothesis that the mean rating is equal to 5.5. The null hypothesis that the means of the ratings given to the three retirement scenarios are equal to each other is rejected at the 1% level in all of the 18 cases associated with the substitution and income effect regimes in the table.

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respondents who choose a particular retirement scenario and the average of the ratings for the regimes defined by retirement age and retirement income (see Table 4.2). In the left hand panel, we merge across the columns with the three income levels (low/middle/high) so that the differences reflect substitution effects. The columns “choice” and “rating” show the percentage of respondents who choose the particular retirement scenario and the average rating given to each scenario. As the incentives to work beyond age 65 increases, more people prefer partial retirement to early retirement, while about the same number of people choose the late retirement scenario. At earlier retirement ages, more people prefer late retirement to early retirement, while fewer people choose the partial retirement scenario. Apart from an age effect, these are in general the substitution effects we would expect. The differences in the average ratings confirm these results.

In the right hand panel, we merge across substitution levels low/middle/high so that differences reflect income effects. The last two columns show the choice percentages and average ratings. As the general level of retirement income increases, more people favor the early retirement scenario and fewer people choose late retirement. This is in line with the expected negative income effect (confirming that leisure is a normal good). The effect on the fraction choosing partial retirement is ambiguous. The average ratings are in line with these results.

The randomization of the wage rate in partial retirement reveals the following result (not presented in the table). The percentages of the people who choose early abrupt retirement, late abrupt retirement and partial retirement are, respectively, 21.5%, 34.9%, and 43.6% when partial retirement does not involve a 10 percent reduction in the wage rate; they are 21.9%, 39.1%, and 39.0% when partial retirement involves a reduction in the wage rate. This shows that a job change in partial retirement, accompanied by a decrease in the wage rate, deters 12% of the respondents who otherwise would have participated in partial retirement so that they instead prefer to continue to work full time without changing jobs. The average ratings for the three retirement scenarios are, respectively, 5.0, 5.7, and 6.4, when partial retirement does not involve a reduction in the wage rate, and 5.1, 5.8, and 6.3 when partial retirement involves a reduction in hourly wage. The null hypothesis of equality of the average ratings across the two groups is not rejected at a 0.10 significance level in the cases of early or late abrupt retirement, as expected since these scenarios are the same in the two cases (the wage reduction only applies during partial retirement). On the other hand, the null is rejected at a 0.10 significance level for the partial retirement rating.

### 4.4 Empirical approach

As described in Section 5.2, respondents choose one of the three scenarios presented to them. We assume that the choice is based upon a random utility model, with the utility from retirement scenario  $s$  for respondent  $i$  given by:

$$U_{is} = z_i' \gamma_s + x_i' \beta_s + u_{is} \quad (4.1)$$

$z_i'$  is a vector of seven treatment variables (the scenario characteristics). In particular, it has dummies for the low and high substitution effect and income effect regimes (the middle

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one is the base category) and for the retirement age regimes 61 and 65 (with 63 as the base category), and a dummy indicating that the hourly wage in partial retirement is lower than before partial retirement (the base category is that the hourly wage remains the same).  $x'_i$  includes the respondent's individual characteristics and variables related to the work and social life of the respondent.  $u_{is}$  is a random utility term.

We assume that the respondent chooses the scenario with the highest utility  $U_{is}$ . Under the assumption that the random terms  $u_{is}$  are independently and identically type-I extreme value distributed, this leads to the standard multinomial logit model (Cameron and Trivedi, 2005; Winkelmann and Boes, 2006). Since we only analyze one choice (among three vignettes) of each respondent, the unit of observation in this model is the respondent; we do not have multiple observations per respondent. The model is estimated with maximum likelihood.

Note that the  $z_i$  in equation (4.1) are *individual specific* but not *alternative specific*;  $\gamma_s$  measures the effect of a change in one of the randomized treatment variables on the utilities of scenario  $s$ . However, attributes of the retirement scenarios are by definition *alternative specific*. This makes the model different from a conditional logit model, where the explanatory variables would reflect the characteristics of the scenarios. We normalize  $\gamma_s$  (and  $\beta_s$ ) to zero for one of the scenarios  $s$  (the benchmark). Our modeling approach therefore has the advantage that the other  $\gamma_s$  immediately give the effect of a treatment variable upon the utility of scenario  $s$  relative to the benchmark scenario. For example, take a dummy for the high reward for later retirement (the high substitution effect regime), which is one of the variables in  $z_i$ . Respondents who are randomized into this regime pay a higher price for retiring earlier. We therefore expect them to choose late abrupt retirement more often, but also to choose partial retirement (starting at the early retirement age) over early retirement more often than in the benchmark case with actuarially fair rewards. If early retirement is chosen as the base regime ( $\gamma_{ER}=0$ ), this implies that the parameters in  $\gamma_{LR}$  and  $\gamma_{PR}$  on the dummy for the high substitution effect regime are expected to be positive, and that the parameter in  $\gamma_{LR}$  is larger than that in  $\gamma_{PR}$ . Note that these parameters are assumed to be the same for all respondents, so the model imposes uniform treatment effects for all respondents in terms of utility differences.

After respondents have made their choice, they rate each scenario on a ten point scale from 1 (not interesting at all) to 10 (perfect). We analyze the ratings given to each scenario using a standard linear regression model estimated by ordinary least squares. We then analyze how the effects of the covariates on the ratings given to a retirement scenario compare to effects of those covariates on the probability of choosing that retirement scenario.

### 4.5 Estimation results

Table 4.4 presents the estimation results of the multinomial logit model, explaining the probability of choosing a particular scenario compared to the benchmark scenario. We present the estimations using two different benchmarks: early (abrupt) retirement and late (abrupt) retirement. For the latter benchmark, we only present the coefficient estimates for the alternative of partial retirement, because early retirement is already compared to late retirement using the first benchmark (left hand side of the table).

*Model fit.* There is no universally accepted goodness of fit measure for discrete choice

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**Table 4.4**

Multinomial logit model explaining the choice of a retirement scenario when the base category is early full retirement or late full retirement

	Late retirement		Partial retirement		Partial retirement	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Treatment variables						
Substitution effect low	-0.304	0.044	-0.116	0.422	0.187	0.138
Substitution effect high	0.123	0.428	0.138	0.360	0.015	0.902
Income effect low	0.368	0.019	0.334	0.030	-0.033	0.787
Income effect high	-0.460	0.002	-0.234	0.104	0.226	0.083
Retirement age 61	0.523	0.001	0.271	0.078	-0.252	0.041
Retirement age 65	-0.505	0.001	-0.220	0.130	0.285	0.031
Wage rate low	0.084	0.506	-0.129	0.290	-0.213	0.040
Background characteristics						
Age	0.019	0.015	-0.000	0.962	-0.019	0.005
Male	0.080	0.554	-0.249	0.062	-0.330	0.003
Married	-0.390	0.005	-0.074	0.582	0.316	0.005
Household size	0.156	0.011	0.059	0.320	-0.097	0.041
Highly educated	0.136	0.323	0.144	0.279	0.008	0.943
High income earner	-0.335	0.017	-0.126	0.359	0.210	0.063
Health impairment	-0.238	0.034	-0.036	0.728	0.202	0.039
Currently working	0.600	0.000	0.571	0.000	-0.029	0.822
Hours on non-work activities	-0.033	0.041	-0.021	0.174	0.012	0.379
Base category	Early retirement				Late retirement	
Observations	1984				1984	
Log-likelihood	-2029.688				-2029.688	
McFadden R-squared	0.039				0.039	
LR test of model significance (p-value)	0.000				0.000	
Hausman-McFadden IIA test (p-value)	0.752		0.866		0.813	

Notes: 1. All the treatment variables are dummy variables which take a value of 1 to indicate the respective regime of the retirement income, retirement age or the wage rate effects, and 0 otherwise. 2. The models include also a constant term. 3. The p-value for the Hausman-McFadden test of IIA that is presented, for example, for late full retirement indicates whether the odds of comparing late full retirement to early full retirement is not affected when partial retirement is excluded from the set of three retirement scenarios in accordance with the IIA assumption of the multinomial logit model.

models (Kennedy, 2009). We consider the McFadden R-squared as an indicator of model fit, comparing the log likelihood value of an unrestricted model with that of an intercept only model. Values of 0.2 to 0.4 indicate an excellent fit (McFadden, 1979). Our model leads to a R-squared value of only 0.039. As an informal indicator of goodness of fit, we compare the fraction of choices in Table 4.3 with the fraction of choices predicted by the multinomial logit model presented in Table 4.5. The comparison shows that the observed raw choices are reasonably close to the predicted choices. The comparison of observed scenario ratings with the ratings predicted by the linear regression model leads to a similar conclusion.

*Model significance.* The likelihood ratio statistic shows that the regressors are jointly significant at the 0.01 level.

*The independence of irrelevant alternatives (IIA) property.* The multinomial logit model

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**Table 4.5**  
Predicted percentage of choices and average ratings under the substitution and income effect regimes

Retirement scenario	Retirement regime	Ret. age	Retirement income, substitution effect regime		Choice (%)	Rating (avg.)	Retirement income, income effect regime		Choice (%)	Rating (avg.)
			Regime	Rep. rates			Regime	Rep. rates		
FR FR PR	65	65	L	0.60/0.70/0.80	30.7	5.8***	L	0.60/0.60/0.60	21.6	5.1***
		70		0.90/1.00/1.10	26.1	5.2***		0.90/1.00/1.10	33.5	5.4*
		65-69		0.75/0.85/0.95	43.2	6.4***		0.75/0.80/0.85	44.9	6.3***
FR FR PR	65	65	M	0.60/0.70/0.80	28.1	5.3***	M	0.70/0.70/0.70	28.0	5.4***
		70		1.00/1.10/1.20	30.0	5.3***		1.00/1.10/1.20	29.8	5.4**
		65-69		0.80/0.90/1.00	41.9	6.3***		0.85/0.90/0.95	42.2	6.3***
FR FR PR	65	65	H	0.60/0.70/0.80	25.0	5.1***	H	0.80/0.80/0.80	34.1	5.7***
		70		1.10/1.20/1.30	31.3	5.5		1.10/1.20/1.30	24.2	5.2**
		65-69		0.85/0.95/1.05	43.7	6.3***		0.95/1.00/1.05	41.7	6.4***
FR FR PR	63	63	L	0.50/0.60/0.70	25.2	5.6*	L	0.50/0.50/0.50	16.7	4.8***
		68		0.70/0.80/0.90	32.6	5.6**		0.70/0.80/0.90	41.0	5.8***
		63-67		0.60/0.70/0.80	42.2	6.4***		0.60/0.65/0.70	42.3	6.3***
FR FR PR	63	63	M	0.50/0.60/0.70	22.0	5.0***	M	0.60/0.60/0.60	20.9	5.0***
		68		0.80/0.90/1.00	37.2	5.7***		0.80/0.90/1.00	38.1	5.8***
		63-67		0.65/0.75/0.85	40.8	6.4***		0.70/0.75/0.80	41.0	6.4***
FR FR PR	63	63	H	0.50/0.60/0.70	18.7	4.7***	H	0.70/0.70/0.70	28.3	5.5
		68		0.90/1.00/1.10	39.1	6.0***		0.90/1.00/1.10	30.1	5.5
		63-67		0.70/0.80/0.90	42.1	6.4***		0.80/0.85/0.90	41.6	6.4***
FR FR PR	61	61	L	0.40/0.50/0.60	18.4	5.2***	L	0.40/0.40/0.40	11.8	4.5***
		66		0.50/0.60/0.70	41.2	6.0***		0.50/0.60/0.70	48.5	6.2***
		61-65		0.45/0.55/0.65	40.4	6.4***		0.45/0.50/0.55	39.7	6.3***
FR FR PR	61	61	M	0.40/0.50/0.60	15.9	4.7***	M	0.50/0.50/0.50	15.8	4.8***
		66		0.60/0.70/0.80	45.3	6.2***		0.60/0.70/0.80	46.2	6.3***
		61-65		0.50/0.60/0.70	38.8	6.4***		0.55/0.60/0.65	38.0	6.3***
FR FR PR	61	61	H	0.40/0.50/0.60	13.5	4.4***	H	0.60/0.60/0.60	20.8	5.1***
		66		0.70/0.80/0.90	47.5	6.4***		0.70/0.80/0.90	38.5	6.0***
		61-65		0.55/0.65/0.75	39.0	6.3***		0.65/0.70/0.75	40.7	6.4***

Notes: FR and PR denotes full and partial retirement, respectively. L, M and H respectively refer to low, middle and high regimes. In the table, for the partial retirement scenario, the replacement rates during the period of partial retirement are not shown but only those during full retirement. About 200 respondents choose one of the three retirement plans and rate each of them under each regime of the substitution and income effects, under each age regime. Totals of choices may not add due to rounding error. 1, 2 and 3 asterisks denote significance respectively at 10%, 5% and 1% based on the test of the null hypothesis that the mean rating is equal to 5.5. The null hypothesis that the means of the ratings given to the three retirement scenarios are equal to each other is rejected at the 1% level in all of the 18 cases associated with the substitution and income effect regimes in the table.

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**Table 4.6**

Average marginal effects of variables on the probability of choosing a retirement scenario

	Early retirement		Late retirement		Partial retirement	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Treatment variables						
Substitution effect low	0.032	0.134	−0.050	0.053	0.018	0.507
Substitution effect high	−0.021	0.346	0.007	0.798	0.015	0.587
Income effect low	−0.056	0.014	0.031	0.211	0.025	0.353
Income effect high	0.054	0.011	−0.067	0.011	0.013	0.633
Retirement age 61	−0.062	0.007	0.075	0.003	−0.013	0.614
Retirement age 65	0.056	0.009	−0.079	0.003	0.023	0.401
Wage rate low	0.005	0.764	0.038	0.073	−0.043	0.049
Background characteristics						
Age	−0.001	0.204	0.004	0.002	−0.003	0.036
Male	0.016	0.408	0.055	0.013	−0.071	0.002
Married	0.035	0.081	−0.075	0.001	0.041	0.090
Household size	−0.017	0.064	0.026	0.008	−0.009	0.369
Highly educated	−0.023	0.256	0.009	0.702	0.014	0.552
High income earner	0.035	0.082	−0.055	0.016	0.020	0.405
Health impairment	0.020	0.186	−0.047	0.018	0.027	0.177
Currently working	−0.094	0.000	0.048	0.068	0.046	0.080
Hours on non-work activities	0.004	0.065	−0.004	0.128	−0.000	0.962

Note: All the treatment variables are dummy variables which take a value of 1 to indicate the respective regime of the retirement income, retirement age or the wage rate effects, and 0 otherwise.

is based on the IIA assumption which implies that the odds of comparing two alternatives is independent of the third alternative. If the assumption is violated, the multinomial logit model is misspecified. We employ the Hausman-McFadden test of the IIA assumption (Hausman and McFadden, 1984), comparing the estimates of a model where all alternatives are considered with those of a model where the third alternative (considered as irrelevant) is excluded. If the excluded alternative is indeed irrelevant to the comparison of the other two alternatives, the coefficient estimates from the two models should not be statistically different from each other. According to the p-values in Table 4.4, we do not reject this null hypothesis, suggesting that the IIA assumption is not violated.<sup>24</sup>

Since it is difficult to give a direct interpretation to the coefficient estimates in a multinomial logit model, Table 4.6 presents the average marginal effects of the regressors on the probability of choosing a particular retirement scenario, based on the estimates in Table 4.4. Note that the marginal effects for the three scenarios add up to zero by construction.

##### 4.5.1 Results on treatment variables

*Substitution effect.* Table 4.4 shows the effects of low and high rewards for late retirement (and delayed claiming) compared to the reference of actuarially fair rewards. The signs of the effects are plausible: Respondents are less likely to choose late retirement in the

<sup>24</sup>We take this result as indicative rather than conclusive because it is shown that the Hausman-McFadden test shows substantial size distortion in Monte Carlo simulations (Cheng and Long, 2007).

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case of a low reward for later retirement. The negative effect of a less than fair reward on the probability to choose late retirement is the largest one and the only significant one, suggesting that individuals are more responsive to a less than fair increase than to a more than fair increase. Table 4.6 quantifies the effect as follows. The probability of delaying full retirement by five years decreases on average by 5.3 percentage points when the actuarial increase in pension benefits due to delaying retirement is 10 percentage points lower than if it was actuarially fair. This finding is in line with the existing literature which shows that individuals are responsive to incentives for retiring later (Burbidge and Robb, 1980; Fields and Mitchell, 1984; Euwals et al., 2010). Table 4.4 shows there is no significant effect of higher or lower rewards on partial retirement.

The substitution effect may depend on the retirement age, since the increase in the replacement rate for delaying retirement is smaller for earlier retirement ages (see Table 4.2). We therefore also allowed the two dummy variables that indicate the low and high rewards to interact with three dummy variables indicating the three regimes of the retirement age (65, 63, 61). The results are presented in Table 4.7, presenting a specification in which the retirement age treatment is interacted with all three other treatments. This specification marginally outperforms the specification without interactions in Table 4.4 according to a likelihood ratio test (the LR test statistic is 22.36; the p-value is 0.0134). We find a statistically significant effect for the high regime of the substitution effect in the earliest retirement age regime, even though the actuarial increase for delaying retirement is lowest in this case. This result suggests that at the early retirement age individuals are more responsive to pension incentives to retire later. It implies that financial incentives for later retirement could be effective if they target those individuals who would tend to retire early (before the statutory retirement age of 65).

*Income effect.* The signs of the income effects are plausible. Respondents are more likely to choose late or partial retirement over early retirement when replacement rates are lower. Table 4.6 shows significant marginal effects for early retirement and late retirement. For example, the probability of delaying full retirement by five years decreases by 6.7 percentage points when the replacement rates are 10 percentage points higher compared to the reference replacement rates. We do not find a significant marginal change for partial retirement. Overall, the results show that when pension income is higher at any retirement age individuals tend to retire earlier or reduce their number of hours worked. This suggests that when individuals achieve a level of pension income that they consider sufficient, they do not want to work longer. The finding is in line with Fields and Mitchell (1984) who showed that an increase in the worker's pension income available for retirement at age 60 induced earlier retirement in the US. This study, however, analyzed the income effect on the binary decision of working versus full retirement. Our results show that the income effect not only exists at the extensive margin, but also influences the number of hours worked at the intensive margin: some respondents prefer partial retirement over early abrupt retirement when pension accruals are less generous, or they prefer partial retirement over late abrupt retirement when pension accruals are more generous. This result suggests that some individuals would use partial retirement to adjust their pension income in a flexible manner when there is a change in the generosity of pension levels.

The income effect might depend on the retirement age. We therefore allow the two



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**Table 4.7**

Multinomial logit model with interaction effects

	Late retirement		Partial retirement		Partial retirement	
	Coeff.	p-val	Coeff.	p-val	Coeff.	p-val
Substitution effect low $\times$ Ret. age 65	-0.265	0.300	-0.352	0.135	-0.087	0.708
Substitution effect high $\times$ Ret. age 65	-0.038	0.884	-0.039	0.872	-0.001	0.998
Substitution effect low $\times$ Ret. age 63	-0.299	0.232	0.057	0.807	0.356	0.088
Substitution effect high $\times$ Ret. age 63	-0.060	0.805	0.051	0.830	0.110	0.577
Substitution effect low $\times$ Ret. age 61	-0.240	0.348	-0.020	0.938	0.220	0.273
Substitution effect high $\times$ Ret. age 61	0.612	0.039	0.555	0.065	-0.057	0.778
Income effect low $\times$ Ret. age 65	0.134	0.610	0.294	0.225	0.160	0.485
Income effect high $\times$ Ret. age 65	-0.233	0.355	-0.226	0.331	0.007	0.976
Income effect low $\times$ Ret. age 63	0.485	0.057	0.399	0.114	-0.086	0.659
Income effect high $\times$ Ret. age 63	-0.672	0.005	-0.285	0.197	0.387	0.067
Income effect low $\times$ Ret. age 61	0.442	0.118	0.357	0.213	-0.085	0.666
Income effect high $\times$ Ret. age 61	-0.441	0.091	-0.183	0.482	0.258	0.209
Wage rate low $\times$ Ret. age 65	0.268	0.206	-0.145	0.457	-0.414	0.030
Wage rate low $\times$ Ret. age 63	0.252	0.220	-0.205	0.304	-0.457	0.008
Wage rate low $\times$ Ret. age 61	-0.236	0.294	-0.089	0.695	0.147	0.376
Retirement age	0.534	0.004	0.089	0.615	-0.445	0.003
Base category	Early retirement			Late retirement		
Observations	1984			1984		
Log-likelihood	-2019.509			-2019.509		
McFadden R-squared	0.044			0.044		
LR test of model significance (p-value)	0.000			0.000		
Hausman-McFadden test of IIA (p-value)	0.460			0.888		
				0.814		

Notes: 1. All the treatment variables are dummy variables which take a value of 1 to indicate the respective regime of the retirement income, retirement age or the wage rate effects, and 0 otherwise. 2. The model also includes the control variables from Table 4.4. The p-value of the Hausman-McFadden test of IIA that is presented, for example, for late full retirement indicates whether the odds of comparing late full retirement to early full retirement is not affected when partial retirement is excluded from the set of three retirement scenarios in accordance with the IIA assumption of the multinomial logit model.

dummy variables that indicate the low and high regimes of the income effect to interact with three dummy variables for the three regimes of the retirement age in Table 4.7. We find a significant income effect between late and early retirement at the earlier retirement ages, suggesting that the income effect is larger at earlier ages, in line with the results in Table 4.3.

*Retirement age effect.* We find significant retirement age effects for all pairs of retirement scenarios. Table 4.4 shows that respondents are more likely to choose late retirement over partial retirement or early retirement, or partial retirement over early retirement in the retirement age regime 61 compared to age regime 63. Table 4.6 shows significant marginal changes for the probabilities of early and late retirement but not for partial retirement (due to offsetting effects). An explanation for these results is that respondents consider the level of pension income at the younger retirement ages insufficient and prefer to remain employed part-time or full-time to accrue additional pension rights. Another reason might be that respondents want to work at least until the traditional retirement ages because of a social norm or because at younger ages the disutility of working is small, for example because of

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(expected) health. Some respondents choose partial retirement when they do not want to retire full-time at the earlier retirement age and do not want to work full-time until the later retirement age. They might also have chosen abrupt retirement at age 62 or 63 if that option would have been available. With our current reduced form analysis we cannot say whether they would prefer this to partial retirement or not; this would require a model imposing more structure.

*Wage rate effect.* Table 4.4 shows the effect of a reduced wage rate accompanied by a job change in partial retirement. We find that respondents are less likely to choose partial retirement if the wage rate is reduced and the employee is required to change jobs. Table 4.6 shows that a 10 percent decrease in the wage rate reduces the probability of choosing partial retirement by 4.3 percentage points. The probability of late retirement increases by 3.8 percentage points. This shows that a reduced wage rate and a job change in partial retirement discourage many individuals to participate in partial retirement so much that they prefer to remain employed full-time. This result is important because a stylized empirical fact in the United States is that partial retirement often involves a reduction in the wage rate and a change in employer or type of work (Honig and Hanoach, 1985; Gustman and Steinmeier, 1983, 1984b, 1986b; Ruhm, 1990; Quinn and Burkhauser, 1993; Johnson and Neumark, 1996; Siegenthaler and Brenner, 2000; Hutchens, 2010).

The effect of a reduction in hourly wage in partial retirement might depend on the retirement age. The model with interactions in Table 4.7 shows that respondents favor late abrupt retirement to partial retirement particularly at the older retirement ages when partial retirement involves a reduced wage rate and job change. This result is striking given the fact that the average respondent prefers to retire early when given the later retirement age scenarios.

##### 4.5.2 Results on background characteristics

The lower panel of Table 4.4 shows the effects of socioeconomic and other background variables. We find significant effects with intuitively plausible signs for all variables:

*Age:* Older respondents more often prefer late abrupt retirement over partial retirement or early abrupt retirement. A reason might be that older respondents want to remain employed to keep their work-related social network or remain physically and mentally active.

*Gender:* Male respondents are more likely to choose early or late abrupt retirement over partial retirement. It might be that the types of work done by men are not suitable for part-time jobs, or that male workers do not need to combine work and family responsibilities as much as females, making them less likely to opt for a flexible work schedule.

*Marital status:* Married individuals are more likely to choose early or partial retirement over late retirement. It might be that the work or pension income of the spouse is sufficient for the household so that the respondent has less of an incentive to work full-time. The preference for partial retirement over late retirement might also reflect that partial retirement gives married individuals the opportunity to combine work and family responsibilities.

*Household size:* Respondents living in households with more members favor late retirement over early or partial retirement, perhaps due to the simple economic reason that a larger household requires a higher income to maintain a given standard of living.

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*Education:* Respondents with more education more often prefer partial retirement over early retirement. It might be that those with more education are more ambitious or more attached to their work and therefore more likely to remain employed; they might prefer to remain employed part-time because the type of work they do is suitable for part-time work.

*Income:* Respondents with higher (former) earnings are less likely to choose late abrupt retirement perhaps because their income is satisfactory. This income effect corresponds to our previous finding that respondents who are randomized into a higher retirement income in the retirement scenarios are less likely to choose late retirement.

*Health:* Those with a health impairment – defined as a health problem that is experienced in the last six months and limits the activities that people usually do – more often prefer early retirement or partial retirement to late retirement, suggesting that partial retirement provides those with a health impairment the opportunity to remain employed.

*Current work status:* Among the survey respondents, those who are currently working for an employer or self-employed are more likely to choose the scenarios with longer years of employment. This might suggest that once individuals leave the labor market, they seem to have no incentive to return to work.

*Time allocation:* We obtain the plausible result that respondents who spend more hours on household and leisure activities favor early retirement. Various reasons could explain this. Some individuals might allocate their time towards household activities where they are more productive. Others may value retirement more if their spouse is retired (Gustman and Steinmeier, 2000a).

##### 4.5.3 Results on other covariates

Table 4.8 presents a model with additional control variables on job characteristics, job satisfaction, and several aspects of life. Wordings of the questions that define these variables are given in the Appendix.

*Job characteristics:* Job characteristics do not seem to be particularly important. The only significant result is that respondents whose job requires intense concentration prefer late or early abrupt retirement over partial retirement, perhaps because the nature of their job requires full-time presence. A similar lower preference for partial retirement is found for jobs that require frequent communication with coworkers, but this is only marginally significant.

*Job satisfaction:* (Former) workers who are satisfied with their relationships with their supervisor and colleagues favor late over early abrupt retirement. This suggests that job satisfaction in terms of the relations with coworkers encourages individuals to remain employed. Respondents who are satisfied with their pay are more likely to choose early retirement or partial retirement over late retirement. This is in line with our previous finding that high income earners are less likely to remain employed. In fact, the income variable itself becomes insignificant if satisfaction with pay is added to the model. We asked the survey respondents to which extent they agree with the statement *I would keep working even if money were not needed*. Higher levels of agreement with this statement significantly increase the odds of remaining employed in a full-time or part-time job. This suggests that individuals who are attached to labor market for non-economic reasons are significantly more likely to remain in

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**Table 4.8**  
Alternative multinomial logit models explaining the choice of a retirement scenario when the base category is early full retirement or late full retirement

	Late retirement		Partial retirement		Late retirement		Partial retirement		Late retirement		Partial retirement	
	Coeff.	p	Coeff.	p	Coeff.	p	Coeff.	p	Coeff.	p	Coeff.	p
Treatment variables												
Substitution effect low	-0.246	0.099	-0.084	0.557	0.162	0.197	-0.361	0.028	-0.142	0.368	0.218	0.098
Substitution effect high	0.168	0.267	0.165	0.267	-0.003	0.978	0.043	0.799	0.065	0.696	0.022	0.871
Income effect low	0.360	0.019	0.328	0.031	-0.032	0.790	0.389	0.026	0.375	0.028	-0.014	0.915
Income effect high	-0.466	0.002	-0.231	0.102	0.235	0.068	-0.614	0.000	-0.359	0.022	0.255	0.062
Retirement age 61	0.530	0.001	0.273	0.074	-0.257	0.034	0.714	0.000	0.442	0.009	-0.272	0.037
Retirement age 65	-0.447	0.003	-0.201	0.157	0.058	0.058	-0.440	0.009	-0.176	0.009	0.265	0.057
Wage rate low	0.062	0.615	-0.152	0.204	-0.214	0.036	0.067	0.632	-0.202	0.129	-0.268	0.015
Background characteristics												
Age							0.031	0.001	0.006	0.453	-0.024	0.002
Male							0.131	0.407	-0.254	0.099	-0.386	0.002
Married							-0.397	0.010	-0.099	0.509	0.012	0.012
Household size							0.121	0.076	0.022	0.735	-0.099	0.057
Highly educated							0.156	0.340	0.208	0.183	0.051	0.689
High income earner							-0.099	0.546	0.062	0.698	0.161	0.219
Health impairment							-0.186	0.157	0.020	0.869	0.206	0.057
Currently working							0.559	0.002	0.585	0.001	0.025	0.866
Hours on non-work activities							-0.034	0.065	-0.019	0.291	0.015	0.293
Job characteristics												
Blue collar worker							0.174	0.430	0.349	0.091	0.175	0.309
Company size							-0.015	0.730	0.027	0.526	0.042	0.240
Lots of physical effort							0.022	0.806	0.040	0.618	0.019	0.786
Intense concentration							-0.005	0.962	-0.162	0.078	0.029	0.029
Frequent communication							0.084	0.370	-0.047	0.602	-0.131	0.076
Keeping up with pace of others							0.029	0.718	0.080	0.307	0.051	0.432
Repetitive job							0.063	0.443	0.043	0.592	-0.021	0.757
Learning new things							-0.019	0.838	0.029	0.745	0.048	0.500
Job satisfaction												
Relationship with coworkers							0.269	0.004	0.240	0.011	-0.029	0.714
Total pay							-0.198	0.012	-0.097	0.211	0.100	0.109
Work is attractive							-0.044	0.659	-0.032	0.745	0.012	0.880
Freedom in decisions							0.110	0.220	0.079	0.376	-0.031	0.659
Work schedule							0.001	0.990	-0.005	0.949	-0.006	0.927
Promotion prospects							-0.099	0.257	-0.093	0.276	0.006	0.933
Supervision							-0.120	0.172	-0.120	0.166	0.001	0.992
Job security							-0.006	0.931	-0.026	0.705	-0.020	0.717
Value work more than money							0.338	0.000	0.282	0.000	-0.056	0.060
Life satisfaction												
Social activities							0.012	0.814	0.103	0.038	0.091	0.022
Promotions at work							-0.009	0.866	-0.030	0.554	-0.021	0.621
Sufficient work income							-0.066	0.341	-0.101	0.138	-0.036	0.525
Problems in family							0.010	0.902	0.076	0.336	0.066	0.326
Education							-0.092	0.087	-0.063	0.219	0.029	0.510
Education matches work							-0.003	0.952	0.004	0.940	0.007	0.872
Base category	Early retirement		Late retirement		Early retirement		Late retirement		Early retirement		Late retirement	
Observations	2000		2000		1825		1825		1825		1825	
Log-likelihood	-2086.124		-2086.124		-1784.044		-1784.044		-1784.044		-1784.044	
Mcfadden R-squared	0.020		0.020		0.080		0.080		0.080		0.080	
LR model significance test (p)	0.000		0.000		0.000		0.000		0.000		0.000	
Hausman-McFadden IIA test (p)	0.892		0.723		0.923		0.946		0.946		0.989	

Notes: 1. All the treatment variables are dummy variables which take a value of 1 to indicate the respective regime of the retirement income, retirement age or the wage rate effects, and 0 otherwise. 2. The models include also a constant term. 3. The p-value of the Hausman-McFadden test of IIA that is presented, for late full retirement indicates whether the odds of comparing late full retirement to early full retirement is not affected when partial retirement is excluded from the set of three retirement scenarios in accordance with the IIA assumption of the multinomial logit model.

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**Table 4.9**

Linear regression model explaining the ratings given to a retirement scenario

	Early retirement		Late retirement		Partial retirement	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Treatment variables						
Substitution effect low	0.547	0.000	-0.167	0.241	0.049	0.670
Substitution effect high	-0.218	0.094	0.178	0.222	-0.023	0.844
Income effect low	-0.310	0.016	0.004	0.976	0.010	0.934
Income effect high	0.369	0.005	-0.267	0.067	0.067	0.567
Retirement age 61	-0.331	0.010	0.431	0.002	-0.032	0.782
Retirement age 65	0.299	0.027	-0.402	0.008	-0.030	0.810
Wage rate low	0.071	0.505	0.043	0.718	-0.189	0.051
Control variables						
Age	-0.026	0.000	0.022	0.002	-0.008	0.172
Male	0.098	0.388	0.101	0.415	-0.290	0.005
Married	0.333	0.005	-0.537	0.000	0.020	0.852
Household size	-0.137	0.005	0.160	0.002	-0.024	0.580
Highly educated	-0.283	0.014	0.151	0.238	0.214	0.035
High income earner	0.439	0.000	-0.042	0.750	0.201	0.055
Health impairment	-0.025	0.804	-0.094	0.392	0.089	0.327
Currently working	-0.550	0.000	0.339	0.021	0.172	0.154
Hours on non-work activities	0.024	0.097	-0.028	0.069	-0.011	0.394
Observations	1984		1984		1984	
R-squared	0.069		0.042		0.014	
F test of model significance (p-val)	0.000		0.000		0.018	

Notes: 1. All the treatment variables are dummy variables which take a value of 1 to indicate the respective regime of the retirement income, retirement age or the wage rate effects, and 0 otherwise. 2. The models also include a constant term.

the labor market. While our findings on substitution and income effects in Section 4.5.1 have shown that economic reasons play an important role, the current finding provides evidence that non-economic reasons also matter. Other variables on job satisfaction are insignificant.

*Life satisfaction:* Respondents who are satisfied with their social life – activities other than the household and paid work activities in the past ten years – choose partial retirement over early or late abrupt retirement. It might be the case that those who already work part-time and divide their time between work and non-work activities often have an active and satisfactory social life. The result might otherwise suggest that those individuals who were satisfied with their social activities in the past favor partial retirement perhaps because it provides them the opportunity to combine work and non-work activities. The result suggests that by allowing individuals to combine work and non-work activities, partial retirement improves the satisfaction people derive from social activities.

#### 4.5.4 Ratings

Our stated preference question on competing retirement scenarios first asked the survey respondents to choose among three alternative retirement scenarios and then to rate each

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scenario on a 10 point scale. In Section 4.3, we have shown that respondents consistently tend to rate the retirement scenario they choose higher than the other two scenarios they do not choose. We interpreted this result as an indication that survey respondents carefully evaluated the retirement scenarios presented to them. Here we check if the survey respondents are also consistent across their choices and ratings with respect to their treatments and background characteristics. That is, we check if the effects of the control variables on the choice probabilities are in line with the effects of those variables on the ratings of the retirement scenarios in a multivariate analysis. We estimate a linear regression model with ordinary least squares, explaining the ratings given to each of the three retirement scenarios. The results are presented in Table 4.9. When we compare the effects on the choice probabilities in Table 4.4 with the effects on the ratings in Table 4.9, we find that they are largely in line with each other. For example, when the wage rate in partial retirement is reduced, respondents become less likely to choose partial retirement over late retirement (Table 4.4), and also give significantly lower ratings to the partial retirement scenario (Table 4.9).

### 4.6 Conclusion

We have taken a stated preference approach to study preferences for (hypothetical) abrupt and partial retirement scenarios, circumventing the problem that actual retirement choices may be based upon restricted choice. We carried out a randomized experiment where we gave survey respondents retirement scenarios with randomized pension incomes, retirement ages, and wage rates during partial retirement. We asked them to choose between several scenarios and to rate each individual scenario on a ten point scale. We find that changes in retirement income, either in terms of the incentives for delaying retirement (substitution effect) or in terms of the generosity irrespective of the retirement age (income effect), affect retirement behavior. The income effect is larger than the substitution effect. The income effect is shown to affect not only the retirement age but also the number of hours worked. Our findings suggest scope for policy interventions to place particular emphasis on partial retirement plans which provide flexible solutions to employees optimizing their retirement paths.

We find plausible signs for a rich set of control variables affecting retirement scenario choice. From a methodological point of view, this suggests that with carefully designed stated preference questions it is possible to measure the true preferences of individuals for different kinds of retirement plans.

We analyzed partial retirement behavior in stated preference data but, of course, there remains the question of whether stated preferences are predictive of actual behavior. In a survey conducted by The Commonwealth Fund in 1989, Quinn and Burkhauser (1994) find that for many older workers, their planned and preferred retirement age are consistent suggesting that people intend to do what they would like to do. For partial retirement in particular, Siegenthaler and Brenner (2000) argue that analysis of longitudinal data suggests that many workers behave as they say they prefer reducing work hours but this depends on the availability of flexible retirement options. Louviere et al. (2000) survey studies in marketing, transport, resource economics and other social sciences, and compare preference parameter estimates based on stated preference data with estimates based on data on actual

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behavior. They find that the two are usually quite close, although formal statistical tests sometimes reject exact equality. These results suggest that stated preferences are indicative of actual behavior but they may differ with respect to market restrictions, individual characteristics, or other unanticipated policy interventions or life events.

## Appendix

#### 4. STATED PREFERENCE ANALYSIS OF FULL AND PARTIAL RETIREMENT IN THE UNITED STATES

Many employees retire fully after working full-time; the age they retire can differ. Other employees go into partial retirement where they work part-time for several years before full retirement.

Below we describe the retirement plans of three employees. All employees are currently working 40 hours a week and earning \$3000 a month. Their retirement plans differ in the following respects:

- Age of retirement
- Retirement income
- Type of retirement (partial or abrupt retirement)

Please compare the plans presented below.

Lisa plans to retire at age 65 . Her retirement income will be \$2100 a month. This plan can be summarized as follows:

Age	62	63	64	65	66	67	68	69	70	71	72
	Work			Retirement							
Hours worked	40 hours			0							
Work income	\$3000			0							
Ret. income	0			\$2100							

Carol plans to retire at age 70. Her retirement income will be \$3300 a month. This plan can be summarized as follows:

Age	62	63	64	65	66	67	68	69	70	71	72
	Work								Retirement		
Hours worked	40 hours								0		
Work income	\$3000								0		
Ret. income	0								\$3300		

Nicole plans to reduce her hours to 20 hours a week and continue in the same job from age 65 to 69. She will earn \$1500 a month and receive a partial retirement income of \$1050 a month. While working part time she will continue to build retirement benefits for full retirement. She will retire fully at age 70. Her retirement income will be \$2700 a month. This plan can be summarized as follows:

Age	62	63	64	65	66	67	68	69	70	71	72
	Work			Partial retirement					Retirement		
Hours worked	40 hours			20 hours					0		
Work income	\$3000			\$1500					0		
Ret. income	0			\$1050					\$2700		

Based on your own preferences, which plan do you find the most attractive?

- ☐ Lisa's plan  
☐ Carol's plan  
☐ Nicole's plan

**Figure 4.1.** Survey representation of competing retirement scenarios



#### 4. STATED PREFERENCE ANALYSIS OF FULL AND PARTIAL RETIREMENT IN THE UNITED STATES

An employee can choose to work part-time after leaving full time work. The duration of part-time work will have consequences for the retirement income.

Below we describe the retirement plans of five employees. All employees are currently working 40 hours a week and earning \$3000 a month. They will stop working full-time at age 65, but some of them plan to continue working 20 hours a week for several years in partial retirement. During that time they will earn \$1500 a month and receive a partial retirement income of \$1050 a month. They will continue to build retirement benefits for full retirement.

The retirement plans of the five employees differ in the following respects:

- Duration of partial retirement
- Retirement income in full retirement

Please compare the plans presented below.

Linda will fully retire directly from full-time work after turning 65. Her retirement income when fully retired will be \$2100 a month. This plan can be summarized as follows:

Age	62	63	64	65	66	67	68	69	70	71	72
	Work			Retirement							
Hours worked	40 hours			0							
Work income	\$3000			0							
Ret. income	0			\$2100							

Mary will spend 1 year in partial retirement after turning 65. Her retirement income when fully retired will be \$2220 a month. This plan can be summarized as follows:

Age	62	63	64	65	66	67	68	69	70	71	72
	Work			Par	Retirement						
Hours worked	40 hours			20 h	0						
Work income	\$3000			150.	0						
Ret. income	0			105.	\$2220						

Elizabeth will spend 2 years in partial retirement after turning 65. Her retirement income when fully retired will be \$2370 a month. This plan can be summarized as follows:

Age	62	63	64	65	66	67	68	69	70	71	72
	Work			Partial	Retirement						
Hours worked	40 hours			20 hours	0						
Work income	\$3000			\$1500	0						
Ret. income	0			\$1050	\$2370						

Donna will spend 3 years in partial retirement after turning 65. Her retirement income when fully retired will be \$2550 a month. This plan can be summarized as follows:

Age	62	63	64	65	66	67	68	69	70	71	72
	Work			Partial retirement	Retirement						
Hours worked	40 hours			20 hours	0						
Work income	\$3000			\$1500	0						
Ret. income	0			\$1050	\$2550						

Barbara will spend 4 years in partial retirement after turning 65. Her retirement income when fully retired will be \$2760 a month. This plan can be summarized as follows:

Age	62	63	64	65	66	67	68	69	70	71	72
	Work			Partial retirement	Retirement						
Hours worked	40 hours			20 hours	0						
Work income	\$3000			\$1500	0						
Ret. income	0			\$1050	\$2760						

Based on your own preferences, which plan do you find the most attractive?

**Figure 4.2.** Survey representation of duration of partial retirement

#### 4. STATED PREFERENCE ANALYSIS OF FULL AND PARTIAL RETIREMENT IN THE UNITED STATES

An employee can often choose the age to enter partial retirement. This choice will have consequences for the retirement income.

Below we describe the retirement plans of four employees. All employees are currently working 40 hours a week and earning \$3000 a month. They plan to work 20 hours a week for a period of five years in partial retirement. During that time they will earn work income and partial retirement income. They will continue to build retirement benefits for full retirement. The retirement plans of the four employees differ in the following respects:

- Age of partial retirement
- Retirement income during partial retirement
- Retirement income during full retirement

Please compare the plans presented below.

Mary will enter partial retirement at age 57. Her retirement income when partially retired will be \$600 and when fully retired \$1500 a month. This plan can be summarized as follows:

Age	55	56	57	58	59	60	61	62	63	64	65	70
	Work		Partial retirement					Retirement				
Hours worked	40 hours		20 hours					0				
Work income	\$3000		\$1500					0				
Ret. income	0		\$600					\$1500				

Barbara will enter partial retirement at age 60. Her retirement income when partially retired will be \$750 and when fully retired \$1800 a month. This plan can be summarized as follows:

Age	57	58	59	60	61	62	63	64	65	66	67	68
	Work			Partial retirement				Retirement				
Hours worked	40 hours			20 hours				0				
Work income	\$3000			\$1500				0				
Ret. income	0			\$750				\$1800				

Michelle will enter partial retirement at age 63. Her retirement income when partially retired will be \$840 and when fully retired \$2250 a month. This plan can be summarized as follows:

Age	59	60	61	62	63	64	65	66	67	68	69	70
	Work				Partial retirement				Retirement			
Hours worked	40 hours				20 hours				0			
Work income	\$3000				\$1500				0			
Ret. income	0				\$840				\$2250			

Sarah will enter partial retirement at age 66. Her retirement income when partially retired will be \$1050 and when fully retired \$3000 a month. This plan can be summarized as follows:

Age	61	62	63	64	65	66	67	68	69	70	71	72
	Work					Partial retirement				Retirement		
Hours worked	40 hours					20 hours				0		
Work income	\$3000					\$1500				0		
Ret. income	0					\$1050				\$3000		

Based on your own preferences, which plan do you find the most attractive?

- ☐ Mary's plan
- ☐ Barbara's plan
- ☐ Michelle's plan
- ☐ Sarah's plan

**Figure 4.3.** Survey representation of age of partial retirement

#### 4. STATED PREFERENCE ANALYSIS OF FULL AND PARTIAL RETIREMENT IN THE UNITED STATES

An employee can work part-time for several years in partial retirement, before she retires fully. During that time she may prefer to do the same type of work she did before with her former employer. On the other hand, she may prefer to do a different type of work with a different employer. The latter choice will have consequences for the work income and retirement income.

Below we describe two retirement options. The options differ in the following respects:

- Type of work and employer in partial retirement
- Work income in partial retirement
- Retirement income in full retirement

Sarah works 40 hours a week and earns \$3000 a month. From age 65 to 68 she plans to work 20 hours a week in partial retirement. She will continue to build retirement benefits for full retirement.

Sarah can choose between two retirement options:

##### Option 1

She can partially retire with her **former** employer and continue to do the **same** type of work she did before. This plan can be summarized as follows:

Age	62	63	64	65	66	67	68	69	70	71
	Work			Partial retirement				Retirement		
				<b>Former Employer Same Type of Work</b>						
Hours worked	40 hours			20 hours				0		
Work income	\$3000			\$1500				0		
Ret. income	0			\$1050				\$2550		

##### Option 2

She can partially retire with a **different** employer than her former employer and do a **different** type of work than she did before. She will then have the opportunity to work on new and less demanding tasks. However, her work income, and retirement income when fully retired, will be lower than in Option 1. This plan can be summarized as follows:

Age	62	63	64	65	66	67	68	69	70	71
	Work			Partial retirement				Retirement		
				<b>Different Employer Different Type of Work</b>						
Hours worked	40 hours			20 hours				0		
Work income	\$3000			\$1200				0		
Ret. income	0			\$1050				\$2400		

Based on your own preferences, which of the two options do you find more attractive?

- ☐ Option 1  
☐ Option 2

**Figure 4.4.** Survey representation of job change in partial retirement

#### 4. STATED PREFERENCE ANALYSIS OF FULL AND PARTIAL RETIREMENT IN THE UNITED STATES

##### *Job characteristics*

Please indicate how often the following characteristics about your [current/last] job are true. My [current/last] job requires...

1. Lots of physical effort such as lifting heavy loads, stooping, kneeling, or crouching
2. Intense concentration or attention
3. Frequent or close communication with other members of a group
4. Keeping up with the pace of others
5. Doing the same things over and over
6. Learning new things

For each item the respondent is allowed to choose among the following frequency alternatives:

1. (Almost) none of the time
2. Some of the time
3. Most of the time
4. (Almost) all of the time

Depending on the labor market status of the survey respondent, the wording of the question changed with respect to the selection in the brackets above. If the respondent never had a job, he or she is allowed to skip the question.

##### *Job satisfaction*

Please indicate how satisfied you [are/were] with the following aspects of your [current/last] job.

1. Total pay
2. Actual work itself (if the work is attractive)
3. Freedom to decide how you do your work
4. Work schedule
5. Promotion prospects
6. Help and supervision from supervisor or manager
7. Relationship with your supervisor and coworkers
8. Job security (for example, risk of lay off)

For each item the respondent is allowed to choose among the following scales of satisfaction:

1. Very dissatisfied
2. Dissatisfied
3. Neutral
4. Satisfied

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##### 5. Very satisfied

Depending on the labor market status of the respondent, the wording of the question changed with respect to the selection in the brackets below. If the respondent never had a job, he or she is allowed to skip the question.

##### *Life satisfaction*

To what extent do you agree or disagree with the following statement? I would [keep, have kept] working even if the money were not needed.

1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly Agree

In the past 10 years [/before your retirement] how many times have you been promoted to a higher position at your workplace?

1. Never
2. One time
3. Two times
4. Three times
5. Four times
6. Five times
7. More than five times

In the past 10 years how sufficient has your [work/(work)] income been to cover your living expenses?

1. Never been sufficient
2. Rarely been sufficient
3. Sometimes been sufficient
4. Often been sufficient
5. Always been sufficient

Thinking of the past 10 years, how satisfied are you with your social activities (in terms of the opportunities for them, time spent on them, their quality)? Social activities include activities other than the household and paid work activities.

1. Totally dissatisfied
2. Dissatisfied
3. Slightly dissatisfied

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4. Neutral
5. Slightly satisfied
6. Satisfied
7. Totally satisfied

In the past 10 years how often did you experience a problem in your family? Family problems include relationship problems, social problems, and health problems in one or more than one family member affecting others in the household.

1. Never
2. Rarely
3. Sometimes
4. Often
5. Always

If you had to go back to school or get new training, would you change the subject you studied or the field you trained in? If I had the opportunity to study or train again I would study....

1. A completely different subject
2. A somewhat different subject
3. A similar subject
4. A quite similar subject
5. Exactly the same subject

To what extent [does/did] the work you do match the subject you studied?

1. It does not match at all
2. It does not really match
3. It somewhat matches
4. It quite matches
5. It exactly matches

## 5 Factors limiting the opportunities for partial retirement

We differentiate between various types of restrictions that might limit the access to partial retirement. We also consider different types of restrictions that might make partial retirement less attractive for employees. Respondents of an online survey are asked to indicate the extent these restrictions apply in their own situation. We analyze the associations between these restrictions and worker characteristics, job characteristics and job satisfaction of the respondents. Principal results indicate that higher income earners, those working in larger companies, and blue-collar workers have limited opportunities for partial retirement. Older workers are much more likely but those who value work for itself rather than for the compensation are much less likely to be discouraged by the labor market restrictions that might make partial retirement less attractive.

### 5.1 Introduction

Partial retirement means that a worker reduces his work hours in a gradual manner over several years before he moves into full retirement.<sup>25</sup> It has economic and non-economic advantages over the alternative full retirement scenario where workers leave their full-time job in one abrupt step. For example, an employee can combine part-time work income with partial pension income during early retirement years when pensions are substantially reduced for early claiming, and smooth his consumption path until the official retirement age when full benefits are payable. Or, partial retirement can enable older workers in poor health to reduce their working hours but remain in the labor force (Laczko, 1988; Pagán, 2009). For the employer, partial retirement provides an opportunity to retain senior workers whose skills and experience are difficult to replace (Laczko, 1988; Olmsted and Smith, 1994; Latulippe and Turner, 2000; Ghent et al., 2001; Munzenmaier and Paciero, 2002; Collison, 2003). At a more macro level, it is considered as a potential policy tool to keep people employed beyond the early or normal retirement ages so that pension claims can be decreased to ameliorate the financial strain on the pension system of an aging country (Laczko, 1988; Latulippe and Turner, 2000; Wadensjö, 2006). Most of the literature on this topic focuses on the US

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<sup>25</sup>Some studies make a distinction between “partial” and “phased” retirement (Gustman and Steinmeier, 1984a). Partial retirement refers to reducing work hours outside the career employer while phased retirement refers to reducing hours within the career employer. On the other hand, “gradual” retirement is almost always used as a generic term. In this paper, we do not make such a distinction and use partial retirement as a generic term with no reference to employer change. The reason for our choice of the term “partial” is the following. In our survey, which we exploit here, respondents are provided with descriptions of “full” and “partial” retirement schemes. In these descriptions, we use the term “partial” retirement with the rationale that it is semantically more comparable to the term “full” retirement than are the terms “phased” or “gradual” retirement to make it easier for the respondents to understand the types of retirement schemes described to them.

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where partial retirement and bridge jobs are more common than in other OECD countries (Kantarci and van Soest, 2008) and we also focus on the US, both in the empirical work and the review of the literature. Partial retirement in an international context is discussed in, for example, Reday-Mulvey (2000) and Latulippe and Turner (2000).

There is substantial interest in partial retirement among employees. In a telephone survey in 1989, employees aged between 50 and 64 are asked if they would prefer to work full-time or part-time if they had a choice. Among 1,645 employees working full-time, 24.7 percent said they would prefer part-time work (Louis Harris and Associates, Inc., 1997). In an Internet panel survey in 2005, 38 percent of the workers ages 50 and older stated interest in participating in partial retirement (Brown, 2005). In the first three waves (1992-1996) of the Health and Retirement Study (HRS), Graig and Paganelli (2000) find that three out of four older workers prefer to reduce their work hours gradually rather than retire abruptly. Siegenthaler and Brenner (2000) report similar figures from other surveys conducted in the United States.

However, few people seem to have enough opportunities for reducing number of work hours in a gradual manner before they move into full retirement. In the Panel Study of Income Dynamics (PSID), about 40 percent of the respondents aged 55 to 65 answered ‘no’ to the question “Could you have worked less if you had wanted to?” (Gustman and Steinmeier, 1983). Quinn and Burkhauser (1994) report that, in a survey conducted by The Commonwealth Fund in 1989, among those working full-time, 21 percent of the men aged 55 to 64 preferred part-time work but only 6 percent had it, and 43 percent of the women aged 50 to 59 wanted to work part time but only 19 percent were doing so. In the first three waves of the HRS, about 80 percent of the employees aged 55 to 64 report that they cannot reduce the number of paid hours below 40 hours per week (Charles and Decicca, 2007). Studies based on actual retirement behavior in the HRS show that only about 20 percent of the workers participate in some form of partial retirement (Gustman and Steinmeier, 2000b; Scott, 2004; Cahill et al., 2006). Hutchens (2010) reports lower fractions from earlier studies in the 1980s. These figures are consistent with the figures from employer surveys. Gustman and Steinmeier (1983) present results from an employer survey conducted in 1979 and show that only about 10 percent of the surveyed employers allow their employees to reduce their work time as they approach retirement. A survey of 406 companies conducted in 1991 shows that only 35 percent offer opportunities to transfer to jobs with reduced pay and responsibilities, or only 21 percent offer a program of “phased retirement” to workers over 55 (Louis Harris and Associates, Inc., 1993). Hutchens (2010) conducted a telephone survey with 950 establishments in 2001-2002. Among them, 67 percent said that partial retirement would be feasible for a generic white-collar worker, and another 15 percent said that partial retirement was possible in some cases, but formal partial retirement programs were rare.

The large gap between the stated and revealed preferences for work hours reduction in old age implies that certain labor market restrictions are keeping older employees from reducing their work hours before they move into full retirement. It seems important to investigate these restrictions for at least two reasons. From a theoretical point of view, any retirement model that treats number work hours as continuous needs to account for the constraints on work hours reduction through full retirement. This is emphasized by



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Gustman and Steinmeier (1983) who argue that in studies of retirement behavior, ignoring minimum hours constraints may lead to biased estimates of the parameters of the utility function. From a policy point of view, two studies show that adverse effects of minimum hours constraints for the economy could be large. Gustman and Steinmeier (2004) estimate that if minimum hours constraints were abolished, for those 65 and above, the increase in part-time workers would be much greater than twice the decline in full-time workers, suggesting a 3 to 5 percentage point increase in full-time work equivalents. Charles and Decicca (2007) find that workers aged 55 to 64 who could not reduce the number of work hours in their regular work schedule are much more likely to be retired by some future date than their peers who could reduce work hours.

Studies identified different types of restrictions on hours reduction in older age. Many of them highlight the importance of restrictions from the employer. For example, fixed employment costs discourage employers to allow employees to work reduced hours (Quinn, 1981; Hurd, 1996). Team production requires that employees work together during the same hours which discourages flexible work schedules for part-time jobs (Jondrow et al., 1983b; Hurd, 1996; Hutchens and Grace-Martin, 2006). Age discrimination against older workers may limit their opportunities for part-time work (Quinn, 1981; Johnson, 2011). In the United States, social security regulation requires that retirement benefits are reduced for people who are 65 years or older and have earnings above an exempt amount, which discourages individuals to work reduced hours and draw pension benefits at the same time (Quinn, 1981; Hurd, 1996). Hutchens (2010) finds that employers are selective when offering opportunities for partial retirement in the sense that if there are regular part-time workers in a worker's job or if a worker requires little supervision, partial retirement is more feasible.

To learn about the factors that restrict the opportunities of employees for partial retirement, Hutchens (2010) conducted, to our knowledge, the first thorough survey with employers. He asked employers if they would allow partial retirement, and conditional on a positive response, in the follow-up question he asked if specific full-time workers of age 55 or over would be allowed to shift into a part-time position if they wanted to. To investigate the factors associated with access to partial retirement, he asked questions on certain worker and job characteristics that are not usually obtained through household or individual level surveys. For example, he asked about the job characteristics (e.g., existence of part-time jobs within the individual's job title) or the work performance (e.g., whether the individual requires little supervision) of a select individual. In the current study, we conduct a survey with current and former employees and ask if their employer would have allowed them to participate in partial retirement if they wanted to. In this respect, our study complements employer views on permitting partial retirement, as studied by Hutchens, with employee perceptions on access to partial retirement. In addition, we review the literature on the reasons why access to partial retirement is hampered, select those factors that are most cited, and ask survey respondents to what extent these reasons indeed would limit their access to partial retirement. Finally, we also ask respondents to evaluate a set of reasons why they could be discouraged to participate in partial retirement.

We collect additional information on worker characteristics, job characteristics, and job satisfaction and analyze their relations to the restrictions on partial retirement. Principal results indicate that income, company size and occupation type are important correlates of

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access to partial retirement. Age and job satisfaction are important correlates of the reasons explaining why partial retirement is less attractive for employees.

This paper proceeds as follows. Section 5.2 introduces the survey data. Sections 5.3 and 5.4 describe the survey design and questions. Section 5.5 analyzes the data using logit models. Section 5.6 discusses policy implications.

### 5.2 Survey on the factors restricting partial retirement

Our aim is to learn about the perceptions of employees for their opportunities for partial retirement. To this purpose we interviewed the respondents of the American Life Panel in November 2010. The American Life Panel is an Internet survey of individuals executed by the RAND Corporation. Respondents are 18 years or older and selected to be representative of the total population. However, the sample is relatively highly educated due to the higher nonresponse rate of less educated individuals. Respondents either use their own computer to log on to the Internet or they are provided a small laptop or a Web TV, which allows them to access the Internet so that the sample also covers households without Internet access. Respondents are interviewed twice a month and are paid an incentive of about \$20 per 30 minutes of interviewing. We restricted our sample to the respondents of age 40 and older because retirement planning would be less relevant to younger respondents. This generated 2028 responses. The questions were asked to individuals who were working for an employer or self-employed, but also to former employees who were retired, homemakers, unemployed, disabled, or temporarily laid off at the time of the survey. For example, respondents who were retired were asked about their monthly work income and their job satisfaction in their last job. The wordings of the questions were adjusted with respect to the labor market status of the respondent.

The survey consisted of three parts. In the first part, we collected information on worker characteristics, job characteristics, and job satisfaction. In the second part, we presented hypothetical full and partial retirement scenarios with associated work and income trajectories over time and asked respondents to choose their favorite retirement scenario. In the third part, we presented respondents with a set of potential reasons that could limit their access to partial retirement or make partial retirement less attractive for them. Since survey respondents were made familiar with various partial retirement plans in the second part of the survey, we expect that respondents evaluated the reasons that restrict their opportunities for partial retirement with a clear understanding of what partial retirement is all about. The exact survey questions and the documents showing the design of the questions can be inspected at <https://sites.google.com/site/tungakantarci/home/research>.

In the next section we present the survey questions on the reasons limiting access to partial retirement, the factors that make partial retirement less attractive for employees, and the questions on other variables of interest. We also explain the theoretical and empirical rationale behind these questions.

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### 5.3 Employer-side restrictions on partial retirement

We asked three questions to assess the opportunities for partial retirement. First, we asked if employees have access to partial retirement with the following question:

Does your employer offer you the possibility of partial retirement? (Partial retirement means that you retire for part of your work week but keep working the other part, for example, from age 65 until age 68.)

Possible answers are “yes”, “no”, and “I don’t know”. This question compares to that analyzed by Hutchens (2010). In a telephone survey of 950 establishments in the United States, Hutchens asked employers if they allow their employees of age 55 or older to shift to a part-time work schedule. Conditional on a positive response, in the follow up question he asked if specific full-time workers have access to partial retirement, to assess whether partial retirement is used selectively for workers in specific types of jobs or for particularly productive workers. Hutchens conducted his survey with employers and therefore directly investigates if a particular employee would be permitted to partially retire. As we conduct our survey with employees, we investigate the perception of employees on whether their employer would permit partial retirement. We believe that comparison of the results based on employee responses in this paper with those based on employer responses in Hutchens (2010) is particularly valuable in showing how perceptions of employees for their opportunities for partial retirement differ from what employers state about the possibility of partial retirement in their establishments.

The preceding question investigates, from the perspective of the employee, whether a particular employer allows partial retirement. However, if the employer does not allow partial retirement, it is still not clear what is keeping the employer from allowing partial retirement. The literature on partial retirement mentions various reasons why employees’ access to partial retirement can be restricted. We selected the most salient ones cited in the literature and asked survey respondents to what extent these factors apply in their own situation. Furthermore, while some factors might limit access to partial retirement, other factors might make partial retirement less attractive. Therefore, we presented the survey respondents with a second set of reasons that might make partial retirement less attractive and asked to what extent they agree with each of these. The question on the factors that limit the applicability and attractiveness of partial retirement started with the following introductory text:

Partial retirement means that you retire for part of your work week but keep working the other part, for example, from age 65 until age 68. Below we present several reasons that might limit the applicability or attractiveness of participating in partial retirement in your case. Please indicate how much you agree with each reason.

We then presented the following reasons that might limit the applicability of partial retirement:

My employer would find the cost of a part-time worker, relative to a full-time worker, too high to offer partial retirement.

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My employer does not offer part-time jobs.

My employer would favor younger people over older people in pay, promotion, task assignments, and therefore would not offer the opportunity to partially retire.

The type of work I do – in terms of its time schedule, tasks, etc. – is not suitable for part-time work.

My pension fund would not allow drawing pension benefits during partial retirement or would reduce final benefits as a result of partial retirement.

Respondents indicated how much they agree with each reason on a seven-point scale from 1 (Strongly disagree) to 7 (Strongly agree). Note that these questions were asked regardless of the answer given to the question of whether the employer allows partial retirement.

The first factor states that, for an employer, the cost of a part-time worker can be high relative to the number of part-time hours that worker is employed. A commonly cited reason is the quasi-fixed employment costs, such as hiring, training, or benefit costs, which do not change with the number of hours worked and hence are the same for part-time and full-time workers (Quinn, 1981; Jondrow et al., 1983b; Montgomery, 1988; Hurd, 1996; Siegenthaler and Brenner, 2000). For example, supervisory costs can be high for part-time workers due to the scheduling complexities of these workers because they are not continuously available or work at irregular hours (Hutchens and Grace-Martin, 2006).

The second reason states that the employer does not offer part-time jobs. This can be due to a general company policy on work hours flexibility. Various reasons may contribute to such a policy. One reason can be the earnings test. The test requires that retirement benefits are reduced for an employee who earns more than some exempt amount. This may induce the employee to work fewer hours so as not to lose benefits. However, employers who would want employees with precious skills to work more than the exempt amount would be frustrated and decide not to offer part-time work (Hurd, 1996; Hutchens and Grace-Martin, 2004). Another reason can be the age discrimination act. The act prohibits discrimination on the basis of age in hiring, promotion, discharge, compensation, or terms, conditions or privileges of employment. This may discourage employers to promote reduced work hours among elderly workers as it might signal age discrimination (Hurd, 1996; Hutchens, 2010; Brown and Schieber, 2003; Johnson, 2011). In fact, a poll showed that 13 percent of the businesses opposed partial retirement for fear of age discrimination lawsuits (Carlson, 2005).

However, employers may indeed favor younger workers over older workers, due to age discrimination or for some other reason, and not offer partial retirement, or offer it only to older workers with precious skills (Johnson, 2011). Therefore, we consider age as a third factor limiting access to partial retirement.

The fourth reason investigates if the technology of work is suitable for part-time work. For example, in a job where members of a team need to interact in the same place at the same hours, part-time employment will be difficult (Jondrow et al., 1983b; Hurd, 1996; Latulippe and Turner, 2000; Hutchens, 2010). Or, in a job where expensive capital needs to be operated on a full-time basis, part-time employment will not be possible (Even and Macpherson, 2004).

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The fifth factor that limits access to partial retirement relates to pension benefit claiming. The pension fund may not allow drawing pension rights while working part-time or may reduce the rights as a result of partial retirement. This may happen because active employees covered by a defined benefit pension scheme are not allowed to draw benefits before they reach their normal retirement age according the Internal Revenue Code (Fields and Hutchens, 2002; Even and Macpherson, 2004; Penner et al., 2002; Hutchens and Grace-Martin, 2006). Moreover, part-time employees may receive reduced benefits if their benefits are based on formulas that place a higher weight on the earnings during the final years of employment (Chen and Scott, 2003; Hutchens and Grace-Martin, 2006).

The reasons explaining why the attractiveness of partial retirement may be limited are presented as follows:

If my hourly wage would be lower during partial retirement than before, it would discourage me from partially retiring.

If I would need to change my employer to partially retire, it would discourage me from partially retiring.

During partial retirement if I would need to do different types of work than I did before, it would discourage me from partially retiring.

If I have a long-term health problem by the time I am about to retire, I would prefer full retirement to partial retirement (Assume that this health problem is not severe enough to limit work activities.)

I would wish to spend time with family and friends, or pursue leisure activities by the time I would normally fully retire and therefore I would prefer full retirement to partial retirement.

Again, we asked respondents to indicate their level of agreement with each statement on a seven-point scale from 1 (Strongly disagree) to 7 (Strongly agree). Empirical evidence shows that partial retirement often involves a change in employer and a reduction in the wage rate (Honig and Hanoch, 1985; Gustman and Steinmeier, 1983, 1984b, 1986b; Siegenthaler and Brenner, 2000). The employee might be forced to seek part-time work with a different employer if his current employer finds the cost of a part-time employee higher than that of a full-time employee (Hutchens, 2010). The employee might need to accept a reduced hourly wage if the shift to part-time work involves a job change and hence a loss in job tenure (Gordon and Blinder, 1980; Quinn and Burkhauser, 1993; Johnson and Neumark, 1996). Or, Jondrow et al. (1983b) hypothesizes that for employers part-time work is less productive and more costly per hour than full-time work which leads to a lower wage per hour. The employee might also be forced to carry out different types of work in partial retirement since partial retirement almost always involves a change in the sector of employment (Ruhm, 1990). In fact, when asked if participating in partial retirement would require that they do different types of work for the same employer, 48% of the respondents 50 years and older indicated that this would make partial retirement less attractive to them (Brown, 2005). These three, i.e. employer change, wage reduction, and change in the type of work, may make partial retirement less attractive, especially for older employees who may in general

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be more reluctant to bear the cost of such changes. A non-economic reason why elderly employees stop working all together rather than reduce hours is deteriorating health. In fact, it is shown that poor health induces many older workers to withdraw from the labor force (Berkovec and Stern, 1991; Blau, 1994; Bound et al., 1999). A last and more of a preference-driven factor is that for those who wish to spend time with family and friends or pursue leisure activities, partial retirement will be less attractive than full retirement. An individual might value retirement more if, for example, his or her spouse is also retired (Gustman and Steinmeier, 2000a).

### 5.3.1 Summary statistics

Table 5.1 presents descriptive statistics for whether the employer offers the possibility of partial retirement. According to the table, 305 (18.1 percent) of the 1684 respondents indicated that partial retirement would be possible, and another 981 (58.2 percent) of the respondents said that partial retirement would not be possible. A sizable number of respondents, 398 (23.6 percent), said they don't know. These figures suggest that the majority of the respondents do not have access to partial retirement. It is important to note that the question is not explicit on whether the employer offers a formal partial retirement program or not. A respondent can have access to partial retirement through an informal agreement or through a formal partial retirement program. These figures are consistent with other studies based on employee surveys (Gustman and Steinmeier, 1983; Charles and Decicca, 2007). However, they are not consistent with Hutchens (2010). Hutchens asked 950 employers if partial retirement would be feasible for a generic white-collar worker. 67 percent said "yes" and another 15percent said "in some cases". This suggests a mismatch between employee and employer perceptions on access to partial retirement, but it should be noted his sample over represents firms with more than 100 employees and is based on only white-collar workers.

The table allows comparisons across respondents who choose among three answer categories. The numbers in columns 1, 3 and 5 are the average values of the respondents' characteristics, while those in columns 2, 4 and 6 are the corresponding standard errors of the means. The standard deviation for a certain characteristic of the respondent in the sample is, of course, much larger. With respect to the worker characteristics, the respondents who answered 'I don't know' are much younger than those who answered 'yes' or 'no'. For example, the average age of the respondents who said 'I don't know' is 52.25 while the corresponding number for the respondents who said 'no' is 58.59. This suggests that younger respondents are less aware of their opportunities for partial retirement with their employer, perhaps because for them retirement is still further away in time and they have not yet given much thought to it. Female respondents and those who have a low income also appear to have given less thought to their retirement plan. These results are consistent with those of Brown (2005) who finds that women and those with a low household income are more likely to answer 'no' when they are described a partial retirement plan and asked if they have ever heard of 'partial retirement'. On average, the respondents who think of having access to partial retirement have more education, are in better health, and are active in the labor market. With respect to job characteristics, those who think of having access to partial retirement are more often working part-time, self-employed, working in smaller

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**Table 5.1**

Characteristics of the employee and if the employee has access to partial retirement

	Does your employer offer you the possibility of partial retirement?					
	“Yes”		“No”		“I don’t know”	
	Mean	SE	Mean	SE	Mean	SE
	(1)	(2)	(3)	(4)	(5)	(6)
Worker characteristics						
Age	57.82	0.56	58.59	0.32	52.25 <sup>b</sup>	0.39
Male	0.45	0.03	0.47	0.02	0.36 <sup>b</sup>	0.02
Education	12.12 <sup>a</sup>	0.12	11.57	0.07	11.64	0.10
No health impairment	2.77 <sup>a</sup>	0.03	2.61	0.02	2.70 <sup>b</sup>	0.03
Married	0.68	0.03	0.67	0.01	0.63	0.02
Household size	0.70	0.06	0.70	0.04	0.97 <sup>b</sup>	0.06
Income	7.55	0.31	7.30	0.16	6.47 <sup>b</sup>	0.22
Retired, homemaker, etc.	0.22 <sup>a</sup>	0.02	0.54	0.02	0.16 <sup>b</sup>	0.02
Job characteristics						
Part-time worker	0.27 <sup>a</sup>	0.03	0.18	0.01	0.20	0.02
Self-employed	0.24 <sup>a</sup>	0.02	0.13	0.01	0.08 <sup>b</sup>	0.01
Company size	3.20 <sup>a</sup>	0.10	3.71	0.05	3.67	0.08
Blue-collar worker	0.10 <sup>a</sup>	0.02	0.19	0.01	0.14 <sup>b</sup>	0.02
Lots of physical effort	1.54 <sup>a</sup>	0.05	1.66	0.03	1.66	0.05
Intense concentration	3.02	0.05	3.03	0.03	2.97	0.04
Frequent communication	3.03	0.05	3.06	0.03	3.03	0.05
Keeping up with others	2.54	0.06	2.60	0.03	2.56	0.05
Repetitive	2.37 <sup>a</sup>	0.05	2.50	0.03	2.61	0.05
Learning new things	2.66 <sup>a</sup>	0.05	2.64	0.03	2.57	0.04
Job satisfaction						
Total pay	3.45 <sup>a</sup>	0.06	3.40	0.03	3.16 <sup>b</sup>	0.06
Work itself	4.09 <sup>a</sup>	0.05	3.86	0.03	3.74 <sup>b</sup>	0.04
Freedom in how work is done	4.17 <sup>a</sup>	0.05	3.82	0.03	3.82	0.05
Work schedule	4.06 <sup>a</sup>	0.05	3.82	0.03	3.82	0.05
Promotion prospects	3.26 <sup>a</sup>	0.06	2.90	0.03	2.88	0.05
Supervision	3.50 <sup>a</sup>	0.06	3.21	0.04	3.38 <sup>b</sup>	0.05
Relationships with colleagues	4.02 <sup>a</sup>	0.05	3.80	0.03	3.89	0.05
Job security	4.02 <sup>a</sup>	0.06	3.57	0.04	3.54	0.05
Work more important than money	4.32 <sup>a</sup>	0.11	3.77	0.06	4.19 <sup>b</sup>	0.09
Number of observations	305		981		398	

Notes: 1. <sup>a</sup> indicates that the difference between the means in columns 1 and 3 is statistically significant at a 0.05 level. <sup>b</sup> indicates the same test for the means in columns 3 and 5. 2. The variables take the following range of values. Age: 40 - 91. Male, married, work status (retired, homemaker, disabled, etc.), part-time status, and self-employed are dummy variables that take a value of 1 or 0. Education: 3 (5th or 6th grade) - 16 (Doctorate degree). Health: 1 (Severely limited), 2 (Limited but not severely), 3 (Not limited). Household size: 0 - 8. Income: 1 (0-499) - 21 (more than 10000). Company size: 1 (1-5) - 6 (500 or more). Blue-collar worker is a dummy variable. Other variables on job characteristics: 1 ((almost) none of time) - 5 ((almost) all of the time). Variables on job satisfaction: 1 (very dissatisfied) - 5 (very satisfied). Work more important than money: 1 (Strongly disagree) - 7 (Strongly agree).

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**Table 5.2**

Descriptive statistics for the factors limiting partial retirement

	Mean	S.D.
Factors limiting the applicability of partial retirement		
Employer finds the cost of part-time worker too high	3.88	1.76
Employer does not offer part-time jobs	3.96	2.19
Employer favors younger people	3.66	1.90
Job is not suitable for part-time work	3.71	2.10
Pension fund does not allow drawing partial pension	4.23	1.85
Factors limiting the attractiveness of partial retirement		
Reduced wage rate	4.75	1.78
Change of employer	4.25	1.91
Change in type of work	3.71	1.79
Health problem	4.85	1.80
Spend time with family	4.73	1.76

Notes: 1. Number of observations is about 2000. 2. Respondents indicated on a seven-point scale from 1 (Strongly disagree) to 7 (Strongly agree) how much they agree with each factor that could limit their access to partial retirement, and with each factor that could make partial retirement less attractive.

companies, working in white-collar occupations, and working in jobs that are physically less demanding. Perhaps the most notable result in the table is that, on average, higher levels of job satisfaction are associated with an affirmative answer of having access to partial retirement. This is true for each of the nine domains of job satisfaction.

Table 5.2 presents descriptive statistics for the reasons why access to or attractiveness of partial retirement is limited. The table shows the means and the standard deviations of the ratings given to each potential factor on a seven-point scale from 1 (Strongly disagree) to 7 (Strongly agree). Among the factors limiting the applicability of partial retirement, employer preference for younger workers has the lowest mean rating with a relatively small standard deviation. On the other hand, restriction on pension benefit claiming has the highest mean rating with the lowest standard deviation. The figures with respect to the reasons limiting the attractiveness of partial retirement suggest that the majority of the respondents would prefer full retirement to partial retirement if they have a long-term health problem by the time they are about to retire, although it is mentioned that this health problem would not be interfering with their ability to work part-time. A change in the type of work appears to be the least important reason limiting the attractiveness of partial retirement.

## 5.4 Variables of interest

### 5.4.1 Worker characteristics

We collected information on a variety of worker characteristics which include age, gender, education, health status, income, employment status, marital status, and household size. Education is based on the question “What is the highest level of school you have completed or the highest degree you have received?”. Answer categories included 16 different levels of educational degrees. We classified individuals into three educational groups: low, medium,



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high. Three dummy variables are created to indicate the three groups.<sup>26</sup> Health status is based on the question “In the last 6 months, to what extent have you been limited because of a health problem in activities that people usually do?”. Answer categories included “Severely limited”, “Limited but not severely”, and “Not limited”. Since the majority of the respondents are not limited because of a health problem, we created a dummy variable that takes a value of 1 if the respondent is not limited, and a value of 0 otherwise. Income is based on the question “Below we present income categories. Can you indicate which category contains your last monthly income from work, after taxes and other deductions? If you don’t know exactly please give your best estimate.” Respondents are presented with 21 income categories with increments of \$500. We classified individuals into three income groups: low, medium, high. Three dummy variables are created to indicate the three groups.<sup>27</sup> Employment status is based on the question “What is your current employment situation?”. Answer categories included “Working for an employer”, “Self-employed”, “Retired”, “Homemaker”, “Unemployed and looking for work”, “Disabled”, “Student or trainee”, “Temporarily laid off, on sick or other leave”, and “Other”. We classified individuals into three employment categories: those working for an employer or self-employed, retired, and other. We created a dummy variable for each category. Marital status is based on the question “Could you tell us what your current living situation is?”. Answer categories included “married or living with a partner”, “separated”, “divorced”, “widowed”, and “never married”. This information is summarized in a dummy variable so that a value of 1 indicates married or living with a partner, and a value of 0 indicates otherwise. Household size is based on the question “How many other people live with you?” where respondents indicate a number from 0 to 10. We created two dummy variables to indicate those living alone and those living with one or more people.

A theoretical rationale to explain how worker characteristics could affect the access to partial retirement is given by Hutchens (2010). The argument is that if a worker asks to move to a part-time job when he reaches the full retirement age of his employer, the employer will permit the worker to move to this job if the worker’s expected surplus (the worker’s expected output minus the market wage) in that job is positive. However, if the worker’s expected surplus, or the worker’s productive characteristics that are correlated with it, is observable by other potential employers, the incumbent employer will need to pay a higher wage and hence not offer part-time job. This leads to the hypothesis that individual productive characteristics that are easily observed by other potential employers, such as age, gender, or education should have little or no effect on the probability of partial retirement. On the other hand, certain job performance indicators that are not easily observed by potential employers should have a significant effect on the probability of partial retirement. Hutchens provides empirical evidence that education and gender indeed have no effect on the odds of having access to partial retirement. The exception, however, is age. Older workers appear to have a higher chance of getting access to partial retirement. One given

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<sup>26</sup>Those with a high school degree or lower are classified as low educated; those with some college but no degree and with an associate degree in college (in an occupational/vocational or academic program) are classified as medium educated; and those with a bachelor’s degree or higher are classified as high educated.

<sup>27</sup>Those earning less than \$2500 are classified as low income earner; those earning \$2500 or more but less than \$3500 are classified as medium income earner; and those earning \$3500 or more are classified as high income earner. Medium income earner is defined with respect to the net average income in the U.S. which is roughly \$3000.

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reason is that an older worker can more credibly threaten to quit. For example, the worker may be eligible for social security or pension benefits and if not permitted to access partial retirement, he or she can retire fully or partially with a different employer. A second reason is that as workers approach their retirement age, the employer may want to retain higher performing workers and offer them partial retirement.

There might still be other ways that worker characteristics could affect the opportunities for partial retirement. With respect to age, employers may be reluctant to offer part-time work to older workers due to fears of low productivity, absenteeism, or high accident rates. Many studies provide evidence that women are involved in part-time jobs more often than men in the United States (Reimers and Honig, 1996; Hirsch et al., 2000; Latulippe and Turner, 2000) or in Europe (Naegel, 1999; Morris and Mallier, 2003; Wadensjö, 2006; Pagán, 2009). This might reflect a preference-driven behavior if women allocate part of their time to other commitments outside the labor market, but it might also reflect that the types of jobs that women do are more compatible with part-time work. In permitting elderly workers to move to a part-time job after their normal retirement age, employers may be selective for educated workers with essential skills. Besides, education, by itself, may increase the chance of working part-time because more educated workers may be more competent to handle different types of work increasing their chances for varied retirement options (Kim and DeVaney, 2005). Or, education may indirectly increase the chance of working part-time through its interaction with occupation type; educated workers usually hold white-collar occupations which are more compatible with part-time work or flexible hours than blue-collar occupations. Those with a health problem may not be allowed to retire part time but be forced to retire all together. With respect to income, Jondrow et al. (1983a) analyze hourly earnings across industries and find that incidence of part-time work is higher in industries with lower hourly earnings. They interpret this result as evidence that part-time work is less productive and more costly per hour than full-time work and therefore is more prevalent in industries with lower hourly earnings.

It is less clear how worker characteristics might interact with the factors that make partial retirement less attractive for employees. One might expect that older workers are more easily discouraged by the employer-side restrictions on partial retirement since it becomes increasingly difficult to derive utility from work as workers age. Hence, older workers would be more reluctant, e.g., to accept a lower hourly wage or to change their type work in partial retirement. Or, those with a health problem might get discouraged by the employer-side restrictions more easily. For example, it might be difficult for a disabled worker to change his type of work or employer for partial retirement. Those who have a working spouse might consent to a lower hourly wage in partial retirement if the income of the spouse is high enough to compensate the reduced wage of the partial retiree. These and other arguments can be developed further but since the literature did not identify clear causal relationships, we will not elaborate on them further. In this respect, worker characteristics might be expected to prove insignificant.

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### 5.4.2 Job characteristics

We collected information on several domains of job characteristics. Respondents are asked to indicate how often the following characteristics about their job are true: lots of physical effort such as lifting heavy loads, stooping, kneeling, or crouching; intense concentration or attention; frequent or close communication with other members of a group; keeping up with the pace of others; doing the same things over and over; and learning new things. Respondents are presented with the following frequency options: (almost) none of the time, some of the time, most of the time, or (almost) all of the time. Responses are coded in four categories from 1, to indicate (almost) none of the time, to 4, to indicate (almost) all of the time.

Information on other job characteristics is collected as follows. We asked employees “How many hours a week do you usually work at your current job?”. Those who are retired, homemaker, unemployed, disabled, or temporarily laid off are asked “How many hours a week did you usually work at your last job?”. We created a dummy variable that takes a value of 1 if the respondent is working or worked less than 35 hours a week to indicate part-time employment, and a value of 0 to indicate full-time employment. To determine if respondents work or worked for an employer or self-employed, we asked all respondents if they are working or worked for an employer or self-employed. We created a dummy variable that takes a value of 1 if the worker is currently working or worked self-employed, and a value of 0 if he or she is currently working or worked for an employer. The size of the company that the respondent is working for is determined by asking “About how many people are employed at the place where you usually work?”. Answer categories included 1-5, 6-15, 16-24, 25-199, 200-499, and 500 or more. We classified the first two categories as a small company, the second and third categories as a medium-sized company, and the last two categories as a large company. Three dummy variables are created to indicate the three groups of company size. Finally, to determine the occupation type, respondents are presented with 22 different types of occupation and are asked to choose the one that best describes the type of work they do or did. We then classified the occupations as blue-collar and white-collar and created a dummy variable where blue-collar occupations are represented by a value of 1, and white-collar occupations by a value of 0.<sup>28</sup>

There are various ways that job characteristics can influence the opportunities for part-time work. For example, jobs that require frequent coordination and communication between team members would be less compatible with part-time work since such jobs require that team members are present at the work place on a continuous basis. On the other hand, repetitive jobs, e.g., would require little coordination between employees and can be

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<sup>28</sup>Blue-collar occupations include the following: Building and grounds cleaning and maintenance occupations; farming, fishing, and forestry occupations; construction and extraction occupations; installation, maintenance, and repair occupations; production occupations; transportation and material moving occupations. White-collar occupations include the following: Management occupations; business and financial operations occupations; computer and mathematical occupations; architecture and engineering occupations; life, physical, and social science occupations; community and social services occupations; legal occupations; education, training, and library occupations; arts, design, entertainment, sports, and media occupations; health care practitioner and technical occupations; health care support occupations; protective service occupations; food preparation and serving related occupations; personal care and service occupations; sales and related occupations; office and administrative support occupations.

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handled by a full-time worker as well as by two part-time workers (Hutchens, 2010). Jobs that involve competition, intense concentration, or new learning would require commitment and hard work on a full-time basis and therefore be less compatible with part-time work. In jobs that involve new learning, employers may fear that they will be unable to recover the training costs before older workers retire and hence not offer part-time work (Johnson, 2011). In fact, Montgomery (1988) provides evidence that positions that require high training costs are less likely to be filled by part-time workers. With respect to part-time status, Hutchens (2010) asked employers whether there are regular part-time workers in a selected full-time worker's job title to determine if a job is technologically compatible with part-time work. He finds that presence of part-time workers in the worker's job title is associated with greater opportunities for partial retirement. Self-employed individuals have more control over their working hours or number of work hours and therefore have better opportunities for partial retirement (Quinn, 1981; Honig and Hanoach, 1985; Quinn and Burkhauser, 1993; Hurd, 1996; Kim and DeVaney, 2005; Parker et al., 2005). Montgomery (1988) provides evidence from a survey with more than 5000 employers that the proportion of part-time workers decline with the size of the establishment. Jondrow et al. (1983a,b) also show that number of work hours and compensation raise with establishment size in the trade, services, and manufacturing industries. Possible reasons include the following. First, larger companies are more likely to have formal rules and procedures and therefore be less flexible in accommodating preferences for reducing work hours (Hutchens and Papps, 2005; Siegenthaler and Brenner, 2000). Second, larger companies may experience higher administrative costs per worker, i.e. a higher quasi-fixed cost, and therefore have lower proportions of part-time workers (Montgomery, 1988). Third, larger companies may involve more team-work and raise the number of work hours above part-time (Jondrow et al., 1983a,b). Blue-collar jobs usually involve physically demanding tasks and it becomes increasingly difficult to meet the demands of such jobs as a worker ages. In fact, workers in blue-collar jobs prefer to retire earlier than those in white-collar jobs (Gustman and Steinmeier, 1986a; Hayward et al., 1989). Hence, companies with many jobs that are physically demanding are probably less likely to offer broad partial retirement arrangements (Hill, 2010).

It is difficult to predict how job characteristics would influence the factors that might make partial retirement less attractive but several mechanisms could be hypothesized. For example, those who work part-time could be expected to get discouraged by the given restrictions less easily perhaps because they are already subject to these restrictions. Or, in jobs that are mentally or physically demanding, individuals could be particularly sensitive to a reduction in wage rate and decide not to participate in partial retirement.

### 5.4.3 Job satisfaction

We collected information on several domains of job satisfaction by asking survey respondents to indicate how satisfied they are with the following aspects of their current job: total pay, actual work itself (if the work is attractive), freedom to decide how you do your work, work schedule, promotion prospects, help and supervision from supervisor or manager, relationship with your supervisor and coworkers, and job security (for example, risk of lay off). Respondents are presented with the following 5 satisfaction levels: very dissatisfied,

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dissatisfied, neutral, satisfied, and very satisfied. We created a variable where we assigned a value of 1 to the first satisfaction level, a value of 2 to the second satisfaction level, and so on, up to a maximum value of 5 for the highest level of satisfaction. As an additional measure of satisfaction with working life in general, we asked respondents to state their level of agreement with the statement "I would keep working even if the money were not needed". Respondents are asked to indicate their level of agreement on a seven point scale from 1 (Strongly disagree) to 7 (Strongly agree).

High job satisfaction could lead to high job performance resulting in increased opportunities for partial retirement. This would indicate that employers are providing opportunities for partial retirement only to those who are better performing in their jobs. This is consistent with Hutchens (2010) who finds that partial retirement is used selectively for workers who are older and productive in the sense that they require little supervision and make an extra effort to get the job done. Henkens et al. (2009) also provide evidence that managers favor delayed retirement only for those workers who are "still keen to work". However, the relationship between job satisfaction and opportunities for partial retirement does not need to be causal. Better opportunities for flexible work arrangements in old age could increase the satisfaction that older workers derive from various aspects of their job (Chen and Scott, 2006).

Section 5.3 presented potential reasons that might make partial retirement less attractive for employees. Not all employees might get discouraged by these reasons to the same degree. Employees with higher job satisfaction might be willing to bear the costs of participating in partial retirement more than employees with lower job satisfaction.

### 5.4.4 Summary statistics

Table 5.3 presents summary statistics on worker characteristics, job characteristics, and job satisfaction. The majority of the sample is older than age 50, not limited because of a health problem in activities that people usually do, working in white-collar jobs, earning less than roughly the average net income of \$3000, and working full-time. The sample over-represents those with higher education. We address this problem by controlling for the education level in our regression analyses. 13.9 percent of the sample is or has been self-employed and would probably face no minimum hours constraints. Compared to the fraction of self-employed in the sample, a much larger fraction is working in small companies. This suggests that those who are working in small companies are not necessarily self-employed and hence free to change their number of work hours. In line with the fact that majority of the sample is working in white-collar jobs, respondents give a low mean rating when asked if their job requires lots of physical effort such as lifting heavy loads, stooping, kneeling, or crouching. They give high mean ratings when asked if their job requires intense concentration or attention, or frequent or close communication with other members of a group. Respondents seem rather satisfied with their job since the mean ratings are above the middle value of the five-point rating scale for many aspects of job satisfaction.

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**Table 5.3**

Descriptive statistics for control variables

Characteristic	Attribute	Fraction
Age	40-49	26.90
	50-59	36.70
	60-69	24.20
	70+	12.20
Gender	Male	42.30
	Female	57.70
Education level	High school degree or lower	19.10
	Some college or assoc. degree in college	37.90
	Bachelor's degree or higher	43.00
Health status	Severely limited	6.40
	Limited but not severely	21.80
	Not limited	71.80
Marital status	Living with a partner	66.40
	Single (divorced, widowed, etc.)	33.60
Household size	Living alone	59.30
	Living with one or more people	40.70
Income level	Less than \$2500	48.64
	\$2500-3500	16.90
	\$3500 or more	34.46
Work status	Working for an employer	50.70
	Working self-employed	9.40
	Retired	22.10
Job characteristics	Homemaker, unemployed, disabled, etc.	17.80
	Full-time worker (current or last job)	79.28
	Part-time worker (current or last job)	20.72
	Work for an employer (current or last job)	86.06
	Work self-employed (current or last job)	13.94
	Small company (1-15 employees)	32.27
	Medium company (16-199 employees)	37.65
	Large company (200 or more employees)	30.08
	White-collar worker	82.26
	Blue-collar worker	17.74
	Lots of physical effort (1-4)	1.68
	Intense concentration (1-4)	3.01
	Frequent communication (1-4)	3.08
	Keeping up with others (1-4)	2.60
	Repetitive (1-4)	2.54
Job satisfaction	Learning new things (1-4)	2.62
	Total pay (1-5)	3.33
	Actual work itself (1-5)	3.86
	Freedom in how work is done (1-5)	3.87
	Work schedule (1-5)	3.87
	Promotion prospects (1-5)	2.95
	Supervision (1-5)	3.30
	Relationships with colleagues (1-5)	3.85
	Job security (1-5)	3.63
	Work more important than money (1-7)	3.81

Notes: 1. Number of observations is about 2000. 2. The last six variables on job characteristics take values from 1 to 4: 1 ((almost) none of the time), 2 (some of the time), 3 (most of the time), 4 ((almost) all of the time). The variables on job satisfaction take values from 1 to 5: 1 (very dissatisfied), 2 (dissatisfied), 3 (neutral), 4 (satisfied), 5 (very satisfied) except that the last variable takes values from 1 to 7: 1 (Strongly disagree), ..., 7 (Strongly agree). The figures represent the means. 3. Percentages may not add to 100% due to rounding error.

### 5.5 Multivariate models

This section uses multivariate models to analyze the probability that an individual has access to partial retirement and the probability that a given reason why access to or attractiveness of partial retirement is limited. All models use the same control variables.

#### 5.5.1 Access to partial retirement

Table 5.4 presents the estimates of the probability that the employer offers the possibility of partial retirement. Possible answers to the associated question are ‘yes’, ‘no’, and ‘I don’t know’. We treat the last category as missing and estimate a binomial logit model to explain whether a respondent could access to partial retirement if he wanted to.

With respect to worker characteristics, there are two findings. First, compared to low income earners, medium income earners have a worse chance to access partial retirement. The effect of high income group is, however, not significant. In terms of the theoretical ideas in Section 5.4.1, a possible explanation is that part-time work is less productive and more costly per hour than full-time work and therefore is associated with lower hourly earnings. Of course, the level of monthly income does not need to reflect the level of hourly earnings although we control for part-time and full-time work hours. We address other potential explanations for the effect of income in the next section.

Second, compared to those individuals who are currently working for an employer or self-employed, those who are retired, homemaker, unemployed, or disabled are clearly more likely to answer ‘no’. This result might reflect one of three things. First, it might reflect subjective perceptions of lack of opportunities for partial retirement. Second, it might reflect a tendency of those who are not working to justify their leaving the labor force. Finally, it might reflect that minimum hours constraints are in fact responsible for them to leave the labor force.

We find no significant effect for age, gender, education, health, and marital status. This is consistent with the hypothesis that individual productive characteristics that are easily observed by outside employers will have little or no effect on the probability of partial retirement. Hutchens (2010) also found that gender, education, and health have no effect on access to partial retirement. However, we do find that some of these variables have significant effects on some specific reasons that could explain why the opportunities for partial retirement are limited as we discuss in the next section.

With respect to job characteristics, there are two findings. First, compared to medium-sized companies (16-199 employees), in small companies (1-15 employees) workers have better opportunities for partial retirement. This is in line with a previous empirical finding by Montgomery (1988) who showed that the proportion of part-time workers declines with the size of the establishment. A possible factor that could explain this result is self-employment. Small companies could be run by self-employed individuals who have more discretion over their number of work hours and therefore can more easily access partial retirement. However, we observe self-employment status and control for its effect in the regression. Table 5.4 shows that the coefficient on self-employed is indeed positive but not significant, but when we drop the variables that control for company size, it almost doubles

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**Table 5.4**

Logit model explaining access to partial retirement

	Employer offers the possibility of partial retirement	
	Coefficient	p-value
Worker characteristics		
Age	0.019	0.103
Male	−0.102	0.547
Medium education	0.120	0.615
High education	0.391	0.117
No health impairment	−0.083	0.656
Married	−0.076	0.644
Single	−0.025	0.887
Medium income	−0.483	0.033
High income	−0.269	0.186
Retired	−1.372	0.000
Homemaker, disabled, etc.	−2.051	0.000
Job characteristics		
Part-time worker	0.196	0.336
Self-employed	0.208	0.374
Small company	0.389	0.060
Large company	0.006	0.973
Blue-collar worker	−0.518	0.035
Lots of physical effort	0.096	0.294
Intense concentration	0.027	0.799
Frequent communication	0.089	0.367
Keeping up with others	0.036	0.670
Repetitive	−0.018	0.849
Learning new things	−0.036	0.720
Job satisfaction		
Total pay	−0.056	0.510
Work itself	0.057	0.615
Freedom in how work is done	0.097	0.391
Work schedule	−0.020	0.840
Promotion prospects	0.190	0.039
Supervision	0.029	0.770
Relationships with colleagues	0.086	0.455
Job security	0.203	0.009
Work more important than money	0.069	0.077
Log-likelihood	−572.686	
Pseudo R square	0.138	
Number of observations	1187	

Notes: 1. Logit model explaining if the employer offers the possibility of partial retirement. 2. The excluded company size medium (16-199 employees).



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and becomes significant at a 0.05 level. In terms of the theoretical ideas in Section 5.4.2, three factors could explain the prevalence of hours constraints in larger companies, which we do not observe and therefore cannot control for. First, larger companies are more likely to have formal rules and procedures in accommodating preferences for working part-time. Second, larger companies may experience higher fixed costs per worker which do not change with the number of work hours. Third, larger companies may involve more team-work and raise the number of work hours above part-time. The next section seeks to address other potential factors that could explain the effect of company size.

The second finding is that blue-collar workers have worse opportunities for partial retirement. This is consistent with the hypothesis that blue-collar jobs involve physically demanding tasks and for a worker approaching retirement age it would be difficult to meet the demands of such jobs. However, the coefficient on blue-collar worker is significant although we condition on physically demanding job. This suggests that blue-collar jobs have other characteristics than physical requirements that limit the opportunities for part-time work.

Several of the job satisfaction variables have significant effects. Those with better promotion prospects and higher job security and those who value work for itself rather than for the compensation have better opportunities for partial retirement. Yet, the relation does not need to be causal. It is very plausible that high job satisfaction could lead to high job performance resulting in increased opportunities for partial retirement. This might indicate that partial retirement is offered selectively for particularly productive workers consistent with Hutchens (2010) who finds that partial retirement is used selectively for workers who are older and productive in the sense that they require little supervision and make an extra effort to get the job done. However, it could also be that better opportunities for flexible work arrangements are increasing the satisfaction that older workers derive from various aspects of their job. Hence, it is important to note that our coefficient estimates might reflect only associations and not causal relationships. In fact, if, e.g., job satisfaction is endogenous, other potential causal effects may not be estimated consistently.

### 5.5.2 Reasons why access to partial retirement is limited

The previous section analyzed the factors associated with access to partial retirement. This section analyzes the factors associated with specific reasons why access to partial retirement can be hampered. These reasons are described in Section 5.3. Table 5.5 presents the estimates of the probability that access to partial retirement limited because of each specific reason. Because respondents indicate their level of agreement with a given reason on a seven-point scale from 1 (strongly disagree) to 7 (strongly agree), the model is estimated with ordered logit.

With respect to worker characteristics, although we did not find a significant effect for gender in the analysis of access to partial retirement, we do find that male workers are particularly more likely to indicate that their employer does not offer part-time jobs and the type of work they do is not suitable for part-time work. Compared to low income earners, medium or high income earners are clearly more likely to indicate that their employer does not offer part-time jobs, would favor younger people in promotion or task assignments, or

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**Table 5.5**

Ordered logit model explaining the factors limiting the applicability of partial retirement

	F1		F2		F3		F4		F5	
	Coeff.	p-val	Coeff.	p-val	Coeff.	p-val	Coeff.	p-val	Coeff.	p-val
Worker characteristics										
Age	-0.010	0.136	0.002	0.708	0.002	0.793	-0.007	0.288	0.013	0.046
Male	0.075	0.448	0.275	0.004	0.123	0.206	0.247	0.011	-0.148	0.136
Medium education	-0.111	0.359	0.009	0.940	0.109	0.391	-0.128	0.316	0.055	0.651
High education	-0.143	0.297	-0.063	0.654	0.124	0.379	-0.295	0.038	-0.124	0.362
No health impairment	-0.166	0.098	0.076	0.445	-0.267	0.011	-0.073	0.470	0.092	0.383
Married	0.069	0.458	0.035	0.710	-0.102	0.275	-0.169	0.068	-0.071	0.439
Single	0.035	0.714	0.066	0.489	-0.002	0.985	0.071	0.456	-0.285	0.003
Medium income	0.078	0.546	0.307	0.014	0.128	0.308	0.285	0.029	0.039	0.767
High income	-0.032	0.773	0.246	0.032	0.302	0.009	0.285	0.013	0.128	0.243
Retired	0.170	0.259	0.708	0.000	0.143	0.332	0.566	0.000	-0.003	0.985
Homemaker, disabled, etc.	-0.126	0.395	0.497	0.001	0.312	0.041	0.255	0.068	0.051	0.719
Job characteristics										
Part-time worker	-0.255	0.035	-0.509	0.000	0.069	0.556	-0.625	0.000	-0.241	0.037
Self-employed	0.161	0.233	0.107	0.458	0.198	0.159	0.017	0.906	0.014	0.920
Small company	-0.250	0.026	-0.182	0.115	-0.267	0.019	-0.047	0.675	-0.335	0.003
Large company	0.113	0.290	0.071	0.501	0.283	0.006	0.020	0.849	0.130	0.219
Blue-collar worker	0.185	0.152	0.579	0.000	0.198	0.129	0.485	0.000	0.193	0.153
Lots of physical effort	0.011	0.816	-0.129	0.014	0.161	0.002	-0.055	0.296	0.120	0.021
Intense concentration	0.074	0.201	-0.044	0.454	0.025	0.690	0.072	0.216	0.005	0.925
Frequent communication	0.013	0.820	-0.082	0.153	-0.076	0.208	0.007	0.907	0.108	0.054
Keeping up with others	-0.008	0.879	0.055	0.291	0.203	0.000	0.040	0.447	0.035	0.512
Repetitive	0.032	0.523	0.012	0.813	-0.069	0.196	0.017	0.746	-0.055	0.285
Learning new things	0.146	0.009	0.119	0.030	0.068	0.229	0.042	0.460	0.027	0.640
Job satisfaction										
Total pay	-0.064	0.189	0.009	0.850	-0.080	0.103	0.059	0.215	-0.052	0.266
Work itself	-0.000	0.996	0.025	0.688	-0.052	0.406	-0.029	0.631	-0.045	0.476
Freedom in how work is done	-0.112	0.071	-0.058	0.296	-0.149	0.012	-0.039	0.501	-0.007	0.907
Work schedule	0.037	0.520	-0.030	0.580	0.126	0.026	-0.112	0.044	0.061	0.263
Promotion prospects	-0.101	0.073	-0.108	0.056	-0.140	0.013	0.039	0.483	-0.009	0.876
Supervision	-0.058	0.321	-0.032	0.585	-0.121	0.039	0.029	0.623	0.030	0.601
Relationships with colleagues	-0.020	0.753	-0.085	0.178	-0.165	0.007	-0.114	0.070	-0.025	0.678
Job security	-0.023	0.593	0.041	0.347	-0.154	0.001	0.024	0.593	0.025	0.575
Work more imp. than money	-0.003	0.902	-0.034	0.165	-0.053	0.030	-0.007	0.770	-0.100	0.000
Log-likelihood	-3268.480		-3238.060		-3286.995		-3308.033		-3132.684	
Pseudo R square	0.013		0.032		0.041		0.028		0.015	
Number of observations	1816		1815		1815		1813		1816	

Notes: 1. Respondents indicated on a seven-point scale from 1 (Strongly disagree) to 7 (Strongly agree) how much they agree with each of the following factors that could limit their access to partial retirement. F1: My employer would find the cost of a part-time worker, relative to a full-time worker, too high to offer partial retirement. F2: My employer does not offer part-time jobs. F3: My employer would favor younger people over older people in pay, promotion, task assignments, and therefore would not offer the opportunity to partially retire. F4: The type of work I do in terms of its time schedule, tasks, etc. is not suitable for part-time work. F5: My pension fund would not allow drawing pension benefits during partial retirement or would reduce final benefits as a result of partial retirement. 2. The excluded company size is 1 to 5 employees.

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the type of work they do is not suitable for part-time work. This result is consistent with that in the preceding analysis of access to partial retirement. A similar pattern holds for those who are retired, homemaker, unemployed, or disabled, compared to those who are currently working for an employer or self-employed.

With respect to job characteristics, there are four findings. First, compared to those who work full-time, those who work part-time are particularly less likely to be limited in their opportunities for partial retirement compared to those who work full-time. This is consistent with Hutchens (2010) who showed that presence of part-time workers in a full-time worker's job title is associated with greater opportunities for partial retirement, or with Hutchens and Grace-Martin (2006) who showed that establishments that employed part-time white-collar workers, that allowed job sharing, and that had flexible starting times are much more likely than other establishments to permit partial retirement. Hence, our result might support the hypothesis that jobs that are technologically more compatible with part-time work offer greater opportunities for partial retirement. We did not find, however, a significant effect for part-time work in the preceding analysis of access to partial retirement.

The second result is that, in three out of five regressions, compared to medium-sized companies, workers in small companies have better opportunities for partial retirement, although we condition on self-employment status. In these three regressions the coefficient on small company is significant at a 0.05 level. However, compared to medium-sized companies, workers in large companies do not appear to have worse opportunities, except for the third reason where we obtain the clear trend that as companies get larger, employers prefer younger workers when offering opportunities for partial retirement. These results are in line with the result of the preceding section that in smaller companies it is easier to access partial retirement. These findings suggest that the relative cost of a part-time worker, employer policy on worker age, and the policy on pension benefit payments differ across small and large companies affecting the opportunities for partial retirement.

Third, in line with our previous finding on access to partial retirement, blue-collar occupations are less likely to offer part-time jobs, as suggested by the second reason, and the types of work in these occupations – in terms of their time schedule, tasks, etc. – are not suitable for part-time work, conditional on physically demanding tasks in those jobs. This suggests that blue-collar jobs have other characteristics than physical requirements that limit the opportunities for part-time work.

Finally, with respect to the second factor, employers are more likely to offer part-time work in jobs that involve a lot of physical effort. On the other hand, the result with respect to the third reason suggests that employers prefer younger workers when offering part-time work opportunities in physically demanding jobs. We conclude that jobs that involve a lot of physical effort are compatible with part-time work but not for older workers limiting their opportunities for partial retirement.

The coefficients on job satisfaction show a clear pattern of negative signs in all five regressions. A first observation with respect to statistical significance suggests that most of the coefficients are individually insignificant but we find that they are jointly significant at a 0.01 level in the regressions of the first three reasons and at a 0.05 level in the fifth regression. The particular case here is the employer's policy on worker age when offering opportunities for partial retirement. Those who are satisfied with many aspects of their

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job are less likely to think that their employer would favor younger people when offering opportunities for partial retirement. However, the relation does not need to be causal and equal treatment of younger and older workers when offering partial retirement could lead to higher job satisfaction. Regardless of the causal direction, this result suggests that job satisfaction, with respect to equal treatment on the basis of age, has a strong relation with opportunities for partial retirement.

We obtain several other results that are very plausible. First, consistent with the hypothesis that more educated individuals are more competent to do different types of work and have a richer set of retirement options, those with high education are less likely to state that the type of work they do is not suitable for part-time work. Note that we obtain this result although we condition on occupation type which is likely to be correlated with education level. Second, healthy workers are less likely to think that their employer would favor younger people when offering opportunities for partial retirement. Third, employers are less likely to offer partial retirement to older workers if the job requires keeping up with the pace of others. Finally, consistent with the hypothesis that training costs limit the opportunities for part-time work, those respondents whose jobs require learning new things perceive that their employers are less likely to offer part-time jobs or more likely to find the relative cost of a part-time worker too high to offer partial retirement.

### 5.5.3 Reasons why the attractiveness of partial retirement is limited

Table 5.6 presents the estimates of the probability that the attractiveness of partial retirement is limited for a specific reason. Since respondents indicate their level of agreement with the given factor on a seven-point scale from 1 (strongly disagree) to 7 (strongly agree), the model is estimated with ordered logit.

There are three main findings. First, older workers are much more likely to be discouraged by employer-side restrictions that might make partial retirement less attractive for them. In particular, older workers are more likely to state that partial retirement would be less attractive if it involves a reduction in the wage rate, an employer change, or a change in the types of work they do. This result is important because it is well established that partial retirement often involves these changes. This implies that older workers prefer to reduce their work hours with their career employer, rather than with a different employer, which is usually called “phased retirement” in the literature. On the other hand, however, older workers are clearly less likely to prefer full retirement over partial retirement where it is indicated that full retirement allows them to spend time with family and friends or pursue leisure activities. This might be due to financial reasons or a desire to combine work and social activities and stay mentally and physically active around the retirement age. Second, those with high education (bachelor’s degree or higher) are less likely to state that a change in employer or the type of work they do would make partial retirement less attractive. This is perhaps because educated people are able to accommodate their skills, or at least more efficiently, in different types of jobs. Third, those who value work for itself rather than for the compensation are less likely to be discouraged by employer-side restrictions in terms of all five different types of restrictions where the effects are significant at a 0.01 level in almost

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**Table 5.6**

Ordered logit model explaining the factors limiting the attractiveness of partial retirement

	F1		F2		F3		F4		F5	
	Coeff.	p-val	Coeff.	p-val	Coeff.	p-val	Coeff.	p-val	Coeff.	p-val
Worker characteristics										
Age	0.025	0.000	0.014	0.020	0.014	0.023	-0.008	0.175	-0.019	0.002
Male	-0.178	0.065	-0.047	0.629	0.030	0.756	0.089	0.366	0.028	0.781
Medium education	-0.036	0.779	-0.118	0.332	-0.109	0.384	-0.032	0.802	0.025	0.839
High education	-0.159	0.256	-0.292	0.032	-0.288	0.040	-0.083	0.543	0.016	0.907
No health impairment	0.012	0.905	0.055	0.582	0.019	0.850	-0.285	0.005	-0.042	0.692
Married	-0.124	0.182	-0.156	0.098	-0.161	0.083	-0.008	0.930	0.171	0.065
Single	-0.071	0.452	-0.018	0.849	-0.095	0.319	0.072	0.449	-0.033	0.722
Medium income	0.344	0.007	0.055	0.667	-0.073	0.572	0.061	0.628	-0.075	0.549
High income	-0.005	0.968	0.097	0.395	-0.063	0.592	-0.007	0.953	-0.175	0.136
Retired	-0.164	0.259	0.005	0.973	-0.079	0.614	0.430	0.002	0.759	0.000
Homemaker, disabled, etc.	-0.069	0.646	-0.015	0.915	-0.092	0.494	0.051	0.729	0.027	0.857
Job characteristics										
Part-time worker	-0.230	0.064	-0.086	0.468	-0.012	0.921	-0.006	0.956	-0.144	0.221
Self-employed	0.057	0.685	0.004	0.978	0.251	0.074	-0.108	0.455	-0.009	0.948
Small company	-0.388	0.001	-0.062	0.583	-0.134	0.236	-0.086	0.461	-0.141	0.203
Large company	-0.022	0.836	-0.030	0.777	0.024	0.821	0.001	0.995	0.082	0.424
Blue-collar worker	0.253	0.063	0.191	0.146	0.152	0.227	-0.147	0.287	0.065	0.634
Lots of physical effort	-0.003	0.962	-0.063	0.250	-0.082	0.125	0.104	0.070	0.109	0.048
Intense concentration	0.003	0.960	0.068	0.238	0.117	0.047	0.004	0.947	0.094	0.113
Frequent communication	0.115	0.053	-0.072	0.212	-0.028	0.629	0.083	0.157	0.051	0.374
Keeping up with others	-0.046	0.384	0.136	0.010	0.041	0.433	0.040	0.464	-0.032	0.525
Repetitive	0.166	0.002	0.018	0.723	0.061	0.246	0.116	0.030	0.066	0.212
Learning new things	0.001	0.987	-0.011	0.843	-0.023	0.677	-0.066	0.238	0.030	0.599
Job satisfaction										
Total pay	-0.043	0.390	0.016	0.759	0.030	0.548	0.008	0.878	0.028	0.569
Work itself	0.018	0.783	0.090	0.165	0.168	0.007	0.068	0.281	0.092	0.142
Freedom in how work is done	0.025	0.661	-0.045	0.448	0.006	0.917	-0.034	0.562	-0.076	0.205
Work schedule	0.126	0.018	0.036	0.506	-0.048	0.366	0.115	0.041	0.006	0.913
Promotion prospects	-0.217	0.000	0.040	0.508	0.072	0.210	0.013	0.828	-0.041	0.490
Supervision	-0.025	0.673	0.078	0.198	0.092	0.117	0.046	0.425	0.062	0.283
Relationships with colleagues	-0.002	0.980	0.000	0.996	-0.103	0.107	-0.096	0.141	-0.121	0.050
Job security	0.015	0.739	0.043	0.307	0.039	0.368	0.106	0.019	0.129	0.005
Work more imp. than money	-0.071	0.005	-0.068	0.006	-0.047	0.064	-0.163	0.000	-0.227	0.000
Log-likelihood	-3297.486		-3437.305		-3393.789		-3273.841		-3260.413	
Pseudo R square	0.020		0.010		0.010		0.021		0.031	
Number of observations	1816		1815		1815		1814		1815	

Notes: 1. Respondents indicated on a seven-point scale from 1 (Strongly disagree) to 7 (Strongly agree) how much they agree with each of the following factors that could make partial retirement less attractive. F1: If my hourly wage would be lower during partial retirement than before, it would discourage me from partially retiring. F2: If I would need to change my employer to partially retire, it would discourage me from partially retiring. F3: During partial retirement if I would need to do different types of work than I did before, it would discourage me from partially retiring. F4: If I have a long-term health problem by the time I am about to retire, I would prefer full retirement to partial retirement. (Assume that this health problem is not severe enough to limit work activities). F5: I would wish to spend time with family and friends, or pursue leisure activities by the time I would normally fully retire and therefore I would prefer full retirement to partial retirement. 2. The excluded company size is 1 to 5 employees.

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all cases. To our knowledge, the existing literature is silent on the role of job satisfaction in the analysis of factors that hamper the practice of partial retirement.

For several other variables we obtain significant effects with plausible signs. First, those in good health are less likely to state that a long-term health problem would lead them to leave the labor market entirely rather than partially. Second, those who are retired, compared to those who are working, are particularly more likely to prefer full retirement over partial retirement if they have a long-term health problem or wish to spend time on non-work activities by the time they are about to retire. This suggests that workers would not return to the labor market, even to work at reduced hours, once they withdraw from the labor market making retirement an absorbing state. Third, those working in jobs that involve lots of physical effort are more likely to prefer full retirement over partial retirement for the same two reasons as for retired individuals. Finally, those working in jobs that involve repetitive tasks are more likely to state that a reduction in hourly wage or a health problem would discourage them to take partial retirement. This suggests that it is difficult to bear the burden of doing repetitive work, and in cases of hardship, workers are likely to quit their job. This is consistent with Honig (1996) who showed that jobs that involve repetitive tasks are positively related to early retirement. However, there are many effects that are statistically insignificant. In fact in Section 5.4 we argued that it is not clear how worker or job characteristics might interact with the reasons why partial retirement less attractive for employees.

### 5.6 Conclusion

Hutchens analyzed the determinants of access to partial retirement in a survey with employers. He found that employers are selective with respect to certain worker and job characteristics when offering partial retirement. This paper analyzed the determinants of access to partial retirement in a survey with employees. Furthermore, it explored the determinants of specific reasons why access to partial retirement is limited and why partial retirement is less attractive for employees.

We find evidence for worker and job characteristics other than those found by Hutchens. In particular, we find that higher income earners, those working in large companies, and blue-collar workers are limited in their opportunities for partial retirement. We also find that older workers and workers with low job satisfaction are two worker groups that are most likely to find partial retirement unattractive due to the five specific reasons that we considered.

Our results show that restrictions on work hours reduction do not target older workers. We showed that among the reasons limiting the applicability of partial retirement, employer preference for younger workers received the lowest mean agreement rating; we did not find any evidence that older workers have limited access to partial retirement; and we showed that employers favor younger workers only in those jobs that require lots of physical effort and keeping up with the pace of others. These results are consistent with Gustman and Steinmeier (1983) and Hutchens and Grace-Martin (2006) who argue that minimum hours constraints are not part of an employer policy targeting older workers but they exist at any age, or with Warr (1993) who argues that rated job performance is unrelated to age, overall

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absenteeism tends to be greater among younger workers, accidents are more common at lower ages, and staff turnover declines with age. An interesting future research direction in this respect would be to compare the restrictions on part-time work among younger and older workers to better understand the types of restrictions that are specifically related to age.

Although we find that minimum hours constraints do not target older workers, we do find that these constraints matter for older workers. The literature has established that partial retirement typically involves a reduction in the wage rate, an employer change, or a change in the types of work. We find evidence suggesting that any of these constraints discourage older workers to participate in partial retirement. Taken together these results suggest that minimum hours constraints exist at any age, but their effect is most pronounced on older workers.

## 6 The effects of partial retirement on health

Recent studies analyzed the effect of retirement on mental and physical health. Some of them find that retirement yields a loss in cognitive skills while others find that retirement preserves physical health. These studies do not account for partial retirement or part-time work. This study aims to fill this gap. We study how the amount of work hours affects the physical or mental health conditions of US residents between 50 and 75 years old in eight waves (1994-2008) of the Health and Retirement Study. To avoid the potential bias due to the fact that deteriorating health conditions can cause employees to work fewer hours, retirement eligibility ages are used as instruments for part-time or full-time work decisions. We also control for, possibly health related, unobserved heterogeneity across individuals. We find that working part-time or full-time deteriorates overall health and memory skills. On the other hand, part-time and full-time working reduces body weight, and part-time white-collar work substantially improves the word recall score. Part-time and full-time workers are also less prone to depression. In general, health status of the elderly responds to working part-time much more than it responds to working full-time, suggesting that the effect of number of hours worked on health outcomes is nonlinear.

### 6.1 Introduction

As in many other countries, the work force in the United States is aging. According to the Bureau of Labor Statistics, between 2010-2020, labor force participation rates of workers between the ages of 25 and 54 will decrease by 0.9 percentage points, while those of workers age 55 and over will increase by 2.8 percentage points. This implies growing costs of retirement and health benefits (Johnson, 2011). Current policy measures aim at keeping older workers in employment so that benefit claims can be decreased to ameliorate the strain on public finances. Perhaps the main policy measure is the increase of the full retirement age to 67 for those workers born in 1960 or later. This implies that older workers will spend more years in the labor market. Therefore, it is essential to know the effects of working, or retirement, on health. In fact, there is a growing literature in the effects of retirement on physical and mental health. The results of the early studies in this literature have been unsatisfactory because they provide little conclusive evidence or they only infer correlation between labor market inactivity and health and do not identify causal mechanisms (Coe and Zamarro, 2011; Rohwedder and Willis, 2010). Recent studies address the endogeneity of the retirement decision using an instrumental variables approach. Rohwedder and Willis (2010), Mazzonna and Peracchi (2010) and Bonsang et al. (2012) find that retirement has a negative effect on cognitive functioning. Charles (2004) finds that those who are retired feel less depressed or lonely. Coe and Zamarro (2011) find that retirement has no effect on depression or cognitive ability but has a positive effect on overall health. Neuman (2008) also finds that retirement has a preserving effect on general health. Most of these studies



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compare the health outcomes of those who are fully retired to the health outcomes of those who are working any positive number of hours, not distinguishing part-time from full-time work.

Few studies analyzed how the actual number of hours worked influences the health conditions of those who still work. In fact, the literature on partial retirement often claims that working part-time instead of full retirement could preserve mental health, as individuals retain their work related social contacts and keep their feelings of usefulness and self-esteem. Partial retirement may also preserve physical health, as individuals remain physically active (Pagán, 2009; Delsen and Reday-Mulvey, 1996). Dave et al. (2008) found that those who report to be partially retired have worse physical health outcomes than those who are fully retired. On the contrary, Neuman (2008) found that not only retirement but also a reduction in the number of hours worked (from full-time to less than full-time) preserves the general or physical health. According to Liu et al. (2009), individuals who report to be partially retired had fewer major diseases and functional limitations than those who are fully retired. The main methodological difficulty in these studies is the identification of the effect of working part-time on health outcomes, due to potential endogeneity: changes in health status may induce employees to work part-time rather than to work full-time or retire. The existing studies have taken different approaches to deal with this potential endogeneity problem. Liu et al. (2009) considers the effect of current work status on future health status. This approach assumes that current expectations of future health status have no effect on the current work decisions. Dave et al. (2008) selects partial retirees who did not have a health problem in the prior survey years. This identification strategy assumes that changes in health status in between the biennial survey years or in the current survey year do not affect the work decisions in the current survey year. Neuman (2008) uses retirement eligibility ages as instruments for the number of hours worked. This is similar to the approach we adopt in this study. The main difference is that we consider working part-time: Neuman sees those who work less than 1200 hours per year (or 3 day a week for 50 weeks a year) as retired - implicitly assuming partial retirement and full retirement are equivalent.

We study whether older employees who work part-time or full-time have better or worse physical or mental health outcomes than those who are fully retired. We take an instrumental variable approach using the retirement eligibility ages of the respondent and the spouse as the instruments of working part-time or full-time. Employing panel data, we also allow for fixed effects, to eliminate the time invariant factors that are potentially correlated with the number of hours worked. The data comes from the Health and Retirement Study (HRS) which includes a rich set of demographic and labor market variables and various health indicators for the same individuals over time. To measure mental health, we use self-rated memory, a test of word recall, and a depression index. To measure physical health, we use self-reported health but also derive a health index by predicting self-reported health from a set of objective measures of physical health, as in Coe and Zamarro (2011). We also use the Body Mass Index as an indicator of overweight.

We find that part-time or full-time work lowers overall health and memory skills, but leads to a much lower body mass index than full-time retirement. Part-time white collar workers appear to perform much better in the word recall test. Part-time and full-time workers are also less prone to depression. In general, health conditions respond much more

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to working part-time than to working full-time. This suggests that the effect of the number of hours worked on health is nonlinear. This is most pronounced for body mass index, consistent with the findings of Au and Hollingsworth (2011).

This paper proceeds as follows. Section 6.2 discusses the empirical model. Section 6.3 describes the data and the health and work effort indicators. Section 6.5 presents the results and robustness checks. Section 6.6 concludes.

### 6.2 Empirical approach

#### 6.2.1 Controlling for heterogeneity

Our aim is to determine the effects of working part-time and full-time on health. The first attempt could be to estimate the parameter of interest by ordinary least squares in the following equation:

$$Y_{it} = \alpha + f^y(S_{it}) + \mathbf{D}_{it}\boldsymbol{\beta} + u_{it} \quad (6.1)$$

$Y_{it}$  is a measure of health, for example the self-reported health or body mass index.  $S_{it}$  is the age of the individual.  $f^y(S_{it})$  is a flexible and continuous polynomial in age that controls for changes in the health outcome with age.  $\mathbf{D}_{it}$  is a vector of two dummy variables indicating working part-time and full-time. The parameter of interest is the vector  $\boldsymbol{\beta}$ , which measures the responses of the health outcome to working part-time and full-time.

OLS on Equation (6.1) leads to a consistent estimator for  $\boldsymbol{\beta}$  only if  $\mathbf{D}_{it}$  is not correlated with the error term  $u_{it}$ . One reason why this assumption may not be satisfied is that individuals might differ from each other because of time invariant idiosyncratic characteristics that are correlated with the health outcome as well as retirement behavior. We follow a fixed effects approach to allow for this, augmenting Equation (6.1) as follows:

$$Y_{it} = \alpha + f^y(S_{it}) + \mathbf{D}_{it}\boldsymbol{\beta} + \mu_i + \nu_{it} \quad (6.2)$$

$\mu_i$  is a time invariant individual specific unobserved variable and it is potentially correlated with  $\mathbf{D}_{it}$  (and with  $S_{it}$ ). The remaining error term  $\nu_{it}$  is assumed to be uncorrelated with the control variables. The main parameters of interest, the effects of working part-time or full-time on the health measure considered, are contained in the vector  $\boldsymbol{\beta}$ . Note that we assume throughout that these “treatment effects” are assumed to be homogeneous across the population. We will relax this assumption somewhat by estimating the model for specific demographic groups. Moreover, Murtazashvilia and Wooldridge (2008) have shown that under some additional assumptions the fixed effects instrumental variables estimator that we use remains consistent for the average treatment effect in the model with heterogeneous treatment effects. Following the main studies on this topic referred to above, however, we will not consider models with heterogeneous treatment effects.

Exploiting the panel structure of the data,  $\mu_i$  is eliminated through the within group transformation:

$$\tilde{Y}_{it} = \tilde{f}^y(S_{it}) + \tilde{\mathbf{D}}_{it}\boldsymbol{\beta} + \tilde{\nu}_{it} \quad (6.3)$$

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where  $\tilde{Y}_{it}$  represents  $Y_{it} - \bar{Y}_i$ , etc. The assumption that  $\nu_{it}$  is uncorrelated with the control variables (strict exogeneity) implies that OLS on Equation (6.2) (the standard within group estimator for static linear panel data models with fixed effects) gives consistent estimates of  $\beta$ .

### 6.2.2 Controlling for endogeneity

A potential problem in Equation (6.3) is that  $\tilde{D}_{it}$  may be correlated with the unobserved  $\tilde{\nu}_{it}$  making the fixed effects estimator for  $\beta$  inconsistent. This might happen because, for example, employees with a work limiting health problem may select themselves into part-time work or full-time retirement (reverse causation). For example, examining the causal effect of health on labor market behavior, Gannon and Roberts (2011) find that in the UK, people aged 50 and over with health problems are more likely to work part-time or to retire completely than to work full-time. Bound et al. (1999) show that in the US, poor health is often followed by labor force exit. Mols et al. (2012) show that most of the patients who are diagnosed with cancer switched to part-time work or stopped working entirely in the Netherlands.

We follow an instrumental variables approach to solve the problem of potential endogeneity of hours worked, exploiting discontinuities in the probabilities to work part-time and full-time as a function of age at the eligibility ages, similar to Coe and Zamarro (2011). Instrumental variables estimation consists of two stages. In the first stage, we estimate two equations explaining the dummies  $D_{it}^j, j = p, f$  for part-time and full-time work:

$$D_{it}^j = f^j(S_{it}) + \mathbf{I}(S_{it} \geq \bar{\mathbf{S}})\boldsymbol{\gamma}^j + \eta_i^j + \epsilon_{it}^j \quad (6.4)$$

$f^j(S_{it})$  are flexible and continuous age polynomials.  $\bar{\mathbf{S}}$  is the vector of early and normal retirement eligibility ages for Social Security benefits and the vector  $\mathbf{I}(S_{it} \geq \bar{\mathbf{S}})$  indicates whether the individual is at least as old as each of these eligibility ages.  $\boldsymbol{\gamma}^j$  measures the discontinuities in the probabilities to work part-time or full-time at the eligibility ages  $\bar{\mathbf{S}}$ . Hence, this is essentially a regression discontinuity approach (Lee and Lemieux, 2010) in a fixed effects panel data model. Since the elements of  $D_{it}^j$  are binary indicators, Equation (6.4) is a linear probability model. The fixed effects  $\eta_i^j$  are time invariant, individual specific unobserved variables and they are potentially correlated with age. Exploiting the panel structure of the data,  $\eta_i^j$  are eliminated through the within group transformation:

$$\tilde{D}_{it}^j = \tilde{f}^j(S_{it}) + \tilde{\mathbf{I}}(S_{it} \geq \bar{\mathbf{S}})\boldsymbol{\gamma}^j + \tilde{\epsilon}_{it}^j \quad (6.5)$$

The predicted values from the first stage are used to estimate the main Equation (6.3) in the second stage:

$$\tilde{Y}_{it} = \tilde{f}^y(S_{it}) + \hat{\tilde{D}}_{it}\beta + \tilde{\nu}_{it} \quad (6.6)$$

$\hat{\tilde{D}}_{it}$  represents the within group transformed part-time and full-time work probabilities predicted from Equation (6.5). To be valid instruments, retirement eligibility ages are required to be relevant predictors of the full-time and part-time work decisions and exogenous to

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health status of the respondent. It is well documented that the retirement ages are strong predictors of the retirement decision and we will also check below that this is the case in our sample. Moreover, it seems quite plausible to assume that health status does not change discontinuously at the institutionally determined eligibility ages. If the selected instruments are indeed valid, the causal effect of working part-time or full-time on health status, measured by  $\beta$ , is consistently estimated using least squares on equation (6.6). The complete two stage estimation procedure corresponds to two-stage least squares estimation.

One might be interested in how the effects of part-time or full-time work vary with demographic or labor market characteristics. Therefore, we will also estimate the effect of part-time or full-time work on health separately for each category of the following attributes: gender, education and occupation type.

### 6.3 Data

The data is taken from the Health and Retirement Study (HRS). HRS is a nationally representative panel study and surveys more than 22,000 Americans over the age of 50 every two years along with their spouses or partners. The survey was launched in 1992 and collects information on, among other things, income, work, pension plans, physical health, cognitive functioning, and health care expenditures. We use eight waves of the survey covering the period from 1994 to 2008 where data is available for all our dependent variables.

The following sample restrictions are imposed. First, we only keep those respondents who are between 50 and 75 years old. Second, we drop respondents who reported they never worked or worked but with a tenure of less than five years on all jobs. Third, we drop respondents who did not work since age 50. Fourth, we drop respondents who report to be working, disabled, unemployed, or not in the labor force after reporting retirement in a previous survey. Finally, we drop the observations of respondents who are disabled, not in the labor force, or unemployed. The reason for this restriction will be explained in Section 6.3.2. These sample restrictions result in a sample of 42,065 observations for 11,376 individuals.

#### 6.3.1 Measuring health

##### Self-reported health

Self-reported health is the self-perceived general health status. It is based on the question "Would you say your health is excellent, very good, good, fair, or poor?" The values of the variable thus range from 1 (excellent) to 5 (poor). Self-assessed health is a global index of health that captures physical and mental health in one simple survey measure. Analyzing self-reported health, however, may lead to biased conclusions about the effect of work hours on health, since respondents may report an inferior health status to justify their labor market status (Bound, 1991). We therefore also consider several alternative indicators of mental and physical health, exploiting the rich health information in the HRS.

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### Self-rated memory and word recall score

We use self-rated memory as a subjective, and word recall as an objective measure of cognitive ability. Self-rated memory is based on the question "How would you rate your memory at the present time? Would you say it is excellent, very good, good, fair, or poor?" and hence ranges from 1 (excellent) to 5 (poor). Word recall is measured as follows. Respondents are presented with a list of 10 words to memorize. They are then asked immediately to recall as many words as possible from the list in any order. After asking other survey questions for about five minutes, they are asked for a second time to recall as many words as possible from the same list. Each immediate or delayed recall of a word is counted, giving a memory score ranging from 0 to 20.

### Depression score

We use the depression indicator developed by the Center for Epidemiologic Studies (CESD-score). The indicator is created by summing binary indicators of whether the respondent experienced the following sentiments all or most of the time: depression, everything is an effort, sleep is restless, felt alone, felt sad, could not get going, did not feel happy, and did not enjoy life. This results in a depression indicator that ranges from 0 to 8.

### Body mass index

We consider the body mass index (BMI) to construct indexes of overweight and obesity. BMI is given by the weight (in kilograms) divided by the square of height of the respondent (in meters). Following the existing literature, overweight is defined as BMI greater than 25 and less than or equal to 30; obesity as BMI greater than 30.

### Health index

Following Coe and Zamarro (2011), we create an objective health index by predicting self-reported health from objective physical and mental health measures. In particular, we estimate the following equation:

$$H_{it} = \alpha + \mathbf{L}_{it}\boldsymbol{\beta} + \phi_i + \varepsilon_{it} \quad (6.7)$$

$H_{it}$  is the self-reported health status.  $\phi_i$  is a time invariant individual specific unobserved error that is potentially correlated with the control variables.  $\mathbf{L}_{it}$  is a vector of objective measures of health including the number of limitations in the activities of daily living (ADL), the number of limitations in the instrumental activities of daily living (IADL), the total number of chronic diseases, a summary index of mobility, whether the respondent reports any overnight hospital stay within the last two years, overweight and obesity dummies, the scores of the word recall test discussed above, the score on a subtraction test for numerical skills, and the CESD score for depression.<sup>29</sup>

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<sup>29</sup> ADL includes problems with bathing, dressing, eating, getting in/out of bed, and walking across a room. IADL includes problems with using the phone, managing money, taking medications, shopping for groceries, and preparing hot meals. Both variables take values from 0 (no problems) to 5 (many problems).

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**Table 6.1**

Results for FE model explaining self-reported health

	Self-reported health	
	Coef	p-val
Difficulty in daily activities	0.051	0.000
Difficulty in instrumental daily activities	0.038	0.009
Difficulty in mobility	0.106	0.000
Difficulty in muscle use	0.073	0.000
Number of chronic diseases	0.189	0.000
Hospital stay	0.020	0.000
Overweight	0.026	0.083
Obese	0.067	0.000
Word recall test	-0.004	0.003
Subtraction test	0.001	0.825
Depression	0.045	0.000
Constant	2.053	0.000
F statistic for overall significance	291	0.000
N observations	32274	
N individuals	9807	

Notes: 1. Linear model with fixed effects. 2. Self-reported health: 1 (Excellent), ..., 5 (poor). 3. Standard errors are corrected for possible heteroskedasticity or correlation over time for a given individual.

Equation (6.7) represents a fixed effects model. After the within group transformation, the predictions of the model, i.e. the estimates of  $\tilde{H}_{it}$ , creates a *health stock* variable that is less prone to reporting bias, as it aggregates objective measures of health, and at the same time reflects one's overall well-being, as measured by the self-assessed health status (Coe and Zamarro, 2011). The estimation results for this equation are presented in Table 6.1. A positive coefficient indicates that an increase in the particular health indicator leads to a self-report of worse health. Most of the coefficients are significant and their signs are plausible. Onsets of physical health problems are associated with reporting poorer health and increasing depression symptoms (higher CESD score) also increase the odds of reporting poor health. A higher score on word recall is associated with reporting better health. On the other hand, the subtraction test result is not related to self-assessed health. Becoming overweight has no significant effect but becoming obese does lead to a significantly poorer self-assessment of health.

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The number of chronic diseases is a count of the following conditions that the respondent has according to a doctor in the current or a previous wave: high blood pressure, diabetes, cancer, lung disease, heart problems, stroke, psychiatric problems, and arthritis. The variable takes values from 0 (none of the conditions) to 8 (all conditions). The mobility index indicates problems with walking one block, walking several blocks, walking across a room, climbing one flight of stairs, and climbing several flights of stairs. The variable takes values from 0 to 5. Serial 7's subtraction test asks the respondents to subtract 7 from 100 and continue subtracting 7 from each subsequent number for a total of five trials. Each correct subtraction is counted, yielding a score from 0 to 5.

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**Table 6.2**

Retirement ages

Year of birth	Retirement ages		
	Early	Normal	Late
1937 or earlier	62	65	70
1938	62	65 and 2 mo.	70
1939	62	65 and 4 mo.	70
1940	62	65 and 6 mo.	70
1941	62	65 and 8 mo.	70
1942	62	65 and 10 mo.	70
1943-1954	62	66	70

Source: The United States Social Security Administration.

### 6.3.2 Measuring work intensity

The aim of our analysis is to examine the effect of working part-time or full-time on health around retirement age. In the HRS, part-time or full-time work can be defined in various ways. Self-reported work status, earnings, or number of hours worked per week or year are all possible indicators of work effort (see, for example, Gustman and Steinmeier, 2000b). As is common in US studies, we define part-time work as working less than 35 hours, full-time work as working 35 or more hours, and full-time retirement as working 0 hours a week.<sup>30</sup> The number of work hours includes the hours in the main job as well as those in a possible second job. As explained above, we exclude individuals who are disabled or out of the labor force; these individuals are not working, not searching for a full-time or part-time job, and do not report to be in retirement. We also exclude those who are unemployed. These individuals work 0 hours but they are likely to be more active than those who are retired, since they report to be searching for a full-time or part-time job.

### 6.3.3 Instruments

We use two sets of instruments for part-time and full-time work. The first set includes three instruments indicating whether respondents are eligible for social security benefits. In particular, the indicators define whether the individual is between the early and normal retirement age, between the normal retirement age but younger than 70, or older than 70. The early and normal retirement ages are presented in Table 6.2. The literature on the effect of retirement on health shows that retirement ages are significant predictors of retirement behavior and are not likely to explain individual health status directly (Charles, 2004; Rohwedder and Willis, 2010; Coe and Zamarro, 2011). Hence, as predictors of retirement behavior or hours of work, dummies for reaching these institutional retirement ages present themselves as natural instruments. We also use an indicator for having reached age 70, when the work decisions of individuals might change for two reasons. First, before the year 2000, Social Security benefits were reduced for those who continued to work at the normal retirement age through age 69 (earnings test). This means that some people might have preferred to return to work or increase their work hours at age 70 when they no longer

<sup>30</sup>Using 20 or 25 hours per week as the cut-off point does not change our qualitative results.

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**Table 6.3**

Employment rates at the retirement eligibility ages (%)

Eligibility age	FT worker	PT worker	FT retiree
Under 62	72.19	15.99	11.82
Between 62 and 65	36.26	19.09	44.65
Between 65 and 70	16.95	17.12	65.92
Over 70	6.64	12.87	80.48
Under 62 (S)	65.38	15.80	18.83
Between 62 and 65 (S)	35.72	18.74	45.53
Between 65 and 70 (S)	22.52	17.38	60.11
Over 70 (S)	10.43	14.52	75.05

Notes: 1. FT: full-time. PT: part-time. S: Spouse. 2. Other employment statuses of ‘disabled’, ‘not in the labor force’, and ‘unemployed’ are excluded from the analysis.

faced the earnings test. Second, individuals are allowed to delay receiving their Social Security benefits at their normal retirement age until age 70 and get compensated for this in the form of increased benefits (in an approximately actuarially fair way). This may induce some people to delay their retirement until age 70.

Following Neuman (2008), we also consider a second set of instruments which consists of the same three age indicators but then for the spouse. Whether the spouse is eligible for Social Security benefits may explain the retirement behavior of an individual whereas it has no direct effect on the health status of that individual. We discuss the robustness of our results to the choice of the instruments in Section 6.5.3.

Neuman (2008) also uses other instruments which are indicators of whether the individual is past the early or normal entitlement age of his or her private pension, or past the self-reported usual retirement age on the particular job. We could not adapt these instruments because there are no observations available for those who are retired. Neuman could use these instruments because he defines retirement as working less than 1,200 hours per year. Besides, HRS asks whether the respondents could reduce paid work hours in their regular work schedule. This variable could be used as an instrument for part-time work but again there are no observations available for those who are retired.

It is clear that at the Social Security eligibility ages many individuals will opt out of full-time work and therefore retirement ages are relevant instruments for the dummy variable defining full-time work in our model. However, it is less clear if individuals will also often choose to work fewer hours at the retirement ages. One possibility is the following. Since the year 2000, Social Security regulations allow individuals who have reached their normal retirement age to draw Social Security benefits and earn work income at the same time. This means that, as of their normal retirement age, individuals may prefer to work part-time rather than retire fully, to supplement their Social Security benefits with work income, especially if Social Security benefits constitute their only retirement income.

Table 6.3 presents the fraction of individuals in three employment states, based on reported hours of work, before the age at which they become eligible for social security, between the early and normal retirement ages, and after the normal retirement age. The table also presents the fraction of the individuals in three employment at the retirement eligibility ages of their spouse. It appears that not only the fraction of those who work



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**Table 6.4**

Descriptive statistics

	Percent		
	All waves	1994 wave	2008 wave
<i>Demographics</i>			
Age (50-75) (avg)	62.84	61.13	63.39
Under 62	45.41	57.38	41.80
Btw 62 and 65	14.21	13.08	15.54
Btw 65 and 70	18.67	11.50	21.84
Over 70	21.71	18.05	20.82
High education	46.27	39.57	54.28
Married	96.94	97.08	95.49
Female	47.83	38.36	43.84
<i>Health</i>			
Self-reported fair or poor health	20.28	18.01	19.17
CESD depression scale (0-8) (avg)	1.16	0.89	0.97
Number of ADL limitations (0-5) (avg)	0.14	0.07	0.12
Number of IADL limitations (0-5) (avg)	0.11	0.07	0.91
Number of mobility limitations (0-5) (avg)	0.70	0.49	0.68
Number of difficulties in muscle use (0-4) (avg)	0.97	0.86	0.99
Number of chronic diseases (0-8) (avg)	1.55	1.16	1.85
Hospital stay in the previous two years	19.43	15.76	20.09
Overweight	41.58	44.48	41.56
Obese	26.15	19.82	32.60
Word recall test score (0-20) (avg)	10.71	9.28	10.78
Subtraction test score (0-5) (avg)	3.82	3.93	3.92
<i>Employment</i>			
Full-time worker	42.54	47.65	41.42
Part-time worker	15.97	16.47	16.03
Full-time retiree	41.50	35.88	42.55
White collar (former) worker	70.17	65.89	70.51

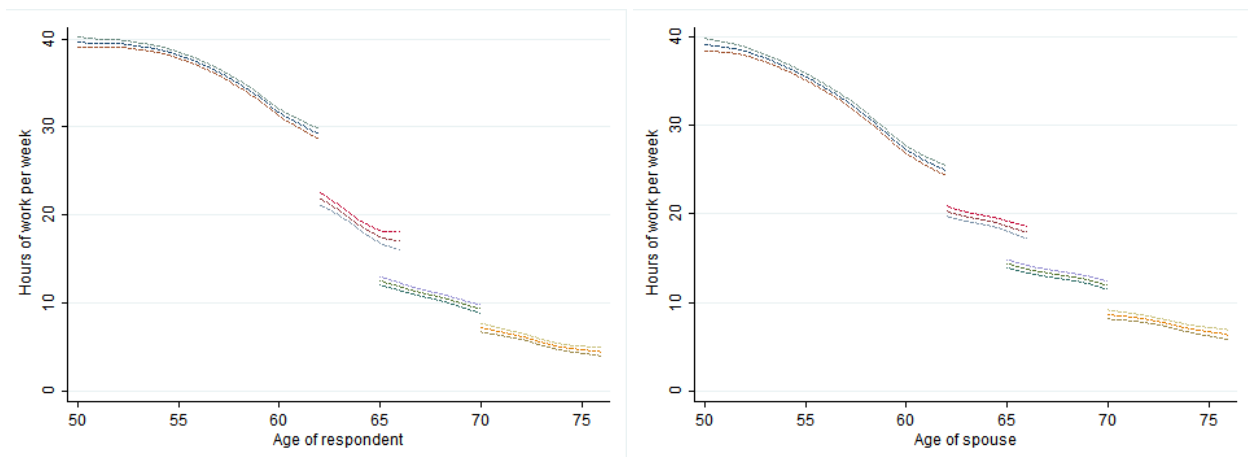
Notes: 1. Totals may not add due to rounding error. 2. Number of observations is 42065 and number of individuals is 11376 in the HRS waves 1994-2008. Number of observations is 5253 and 4703 respectively in the 1994 and 2008 waves.

full-time but also that of those who work part-time change considerably at the retirement eligibility ages or at age 70. These figures suggest that retirement ages are relevant predictors of the number of hours worked in old age.

### 6.3.4 Descriptive statistics

Table 6.4 presents descriptive statistics for the full sample selected using the exclusion criteria in Section 6.3. It also presents the statistics for the first and last wave of the survey so that changes in the statistics can be compared over time. Over the whole survey period, the average age of the sample is 62.8 years where 14.2 percent is between the early and normal retirement ages and 40.4 percent is above the normal retirement age. 46 percent have some college or a higher degree. 72.5 percent of the sample is married. About 20 percent report that their health is fair or poor. The sample does not appear to be particularly prone to depression; the average depression score is 1.16 out of 8. As objective indicators of general

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**Figure 6.1.** Hours per week by age of the respondent and the age of spouse. Kernel smoothed local polynomials and 95 percent confidence intervals around them.

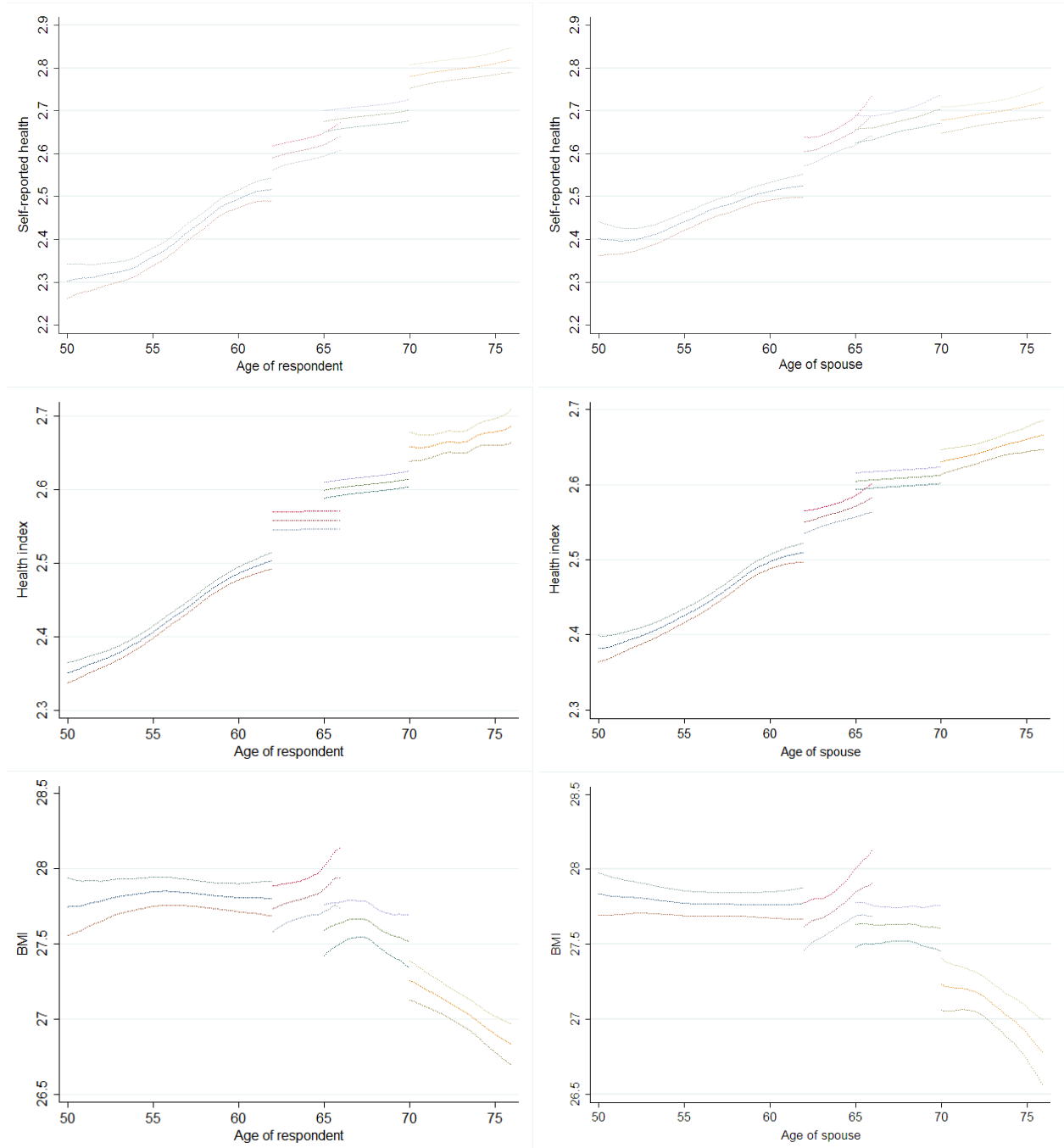
physical health, the average number of difficulties in daily activities or in mobility or muscle use seems low. The average number of chronic diseases is 1.54 out of 8. Almost 42 percent of the sample is overweight and 26 percent is obese. While the average score of the word recall test is just above half of its maximum, the score of the subtraction test seems much higher. 42.5 percent of the sample works 35 hours or more while another 16 percent works less than 35 hours at the time of the survey. [It is not clear to me now whether these variables are based upon reported hours of work or on self-reported employment status] The sample consists mainly of white collar workers. There are plausible changes in the statistics between the first and last waves. The most notable is that health status deteriorates across all health indicators.

### 6.4 Exploratory graphical analysis

In our empirical approach, identification of the effects of working part-time and full-time on health relies on the discontinuities in the probabilities of working part-time and full-time upon reaching the retirement eligibility ages of the respondent and his or her spouse. Here we provide exploratory graphical analysis of the jumps in the conditional mean of the treatment (the number of hours worked) and outcome (health) variables at the points of discontinuity in the assignment (retirement eligibility ages) variable .

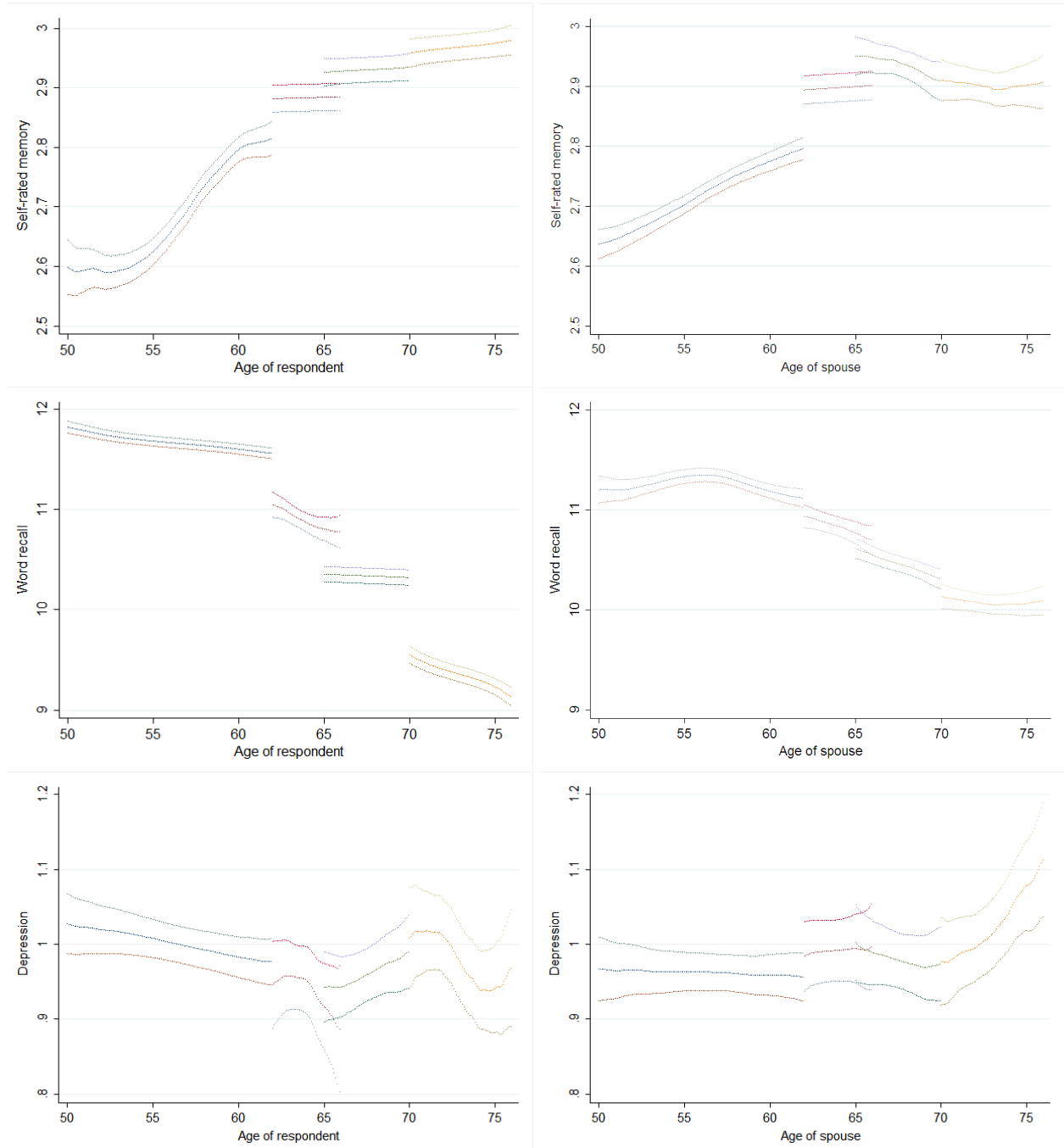
Figure 6.1 presents univariate nonparametric regression of individual number of work hours against the age of the individual and against the age of his or her spouse allowing for jumps at the retirement eligibility ages. We also draw 95 percent confidence bounds around each curve. There are obvious discontinuities at the cutoff ages and the jumps are in the expected direction. The bounds never cross the curves suggesting that the jumps are statistically significant. The jumps are more pronounced at the cutoff ages of the individual than at those of their spouse, however. These suggest that part-time and full-time work probabilities change significantly at the retirement eligibility ages, which supports our identification strategy. Note that, however, the plot is based on univariate regression and does

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**Figure 6.2.** Health status by age of the respondent and the age of spouse. Kernel smoothed local polynomials and 95 percent confidence intervals around them.

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**Figure 6.3.** Health status by age of the respondent and the age of spouse. Kernel smoothed local polynomials and 95 percent confidence intervals around them.

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not control for the effect of the age of spouse. In the next section we present formal tests of whether the dummy variables for the discontinuities are jointly powerful enough to serve as good instruments for both part-time and full-time work status.

In Figures 6.2 and 6.3, six health indicators are plotted against the ages of the individual and spouse to inspect jumps in health status at the retirement eligibility ages of the individual and the spouse. Significant jumps are apparent at the retirement ages of the individual in self-reported health, health index, self-rated memory, and word recall score. The jumps are much less clear at the retirement ages of the spouse than at the individual's own retirement ages.

### 6.5 Results

#### 6.5.1 Instrument relevance and validity

Table 6.5 presents the coefficient estimates from the first stage fixed effects estimation of Equation (6.5).<sup>31</sup> The errors of the linear probability model are heteroskedastic by construction of the model and the predictions of the model may lie outside the unit interval. We correct the standard errors of the estimates for heteroskedasticity and the predictions of the model lie outside the unit interval for only 16 cases. The results show that the retirement eligibility ages of the respondent significantly decrease the probability of working 35 or more hours and significantly increase the probability of working less than 35 hours. The effect on working 35-70 hours appears to be larger than that on working 01-34 hours. This is plausible since the majority of the employees opt out of full-time work when they are eligible for social security benefits, according to Table 6.3. The retirement ages of the spouse also appear to be predictive of the respondent's own retirement behavior. It may be that when the spouse is eligible for social security benefits, the respondent becomes less inclined to work full-time or part-time. In fact, Gustman and Steinmeier (2000a) finds that an individual values retirement more once their spouse has retired. Besides, we find that retirement ages of the spouse, in particular being between 65 and 70 years old or over 70 years old, have the same significant negative effects on the probabilities of part-time retirement and part-time work.

The table shows that the retirement age indicators are jointly significant at the 0.01 level. The table also shows that the continuous age variables are also jointly significant at the 0.01 level. Angrist and Pischke (2009, pp. 217-18) introduced an F statistic for testing weak identification when there is more than one endogenous regressor. The test is carried out by first regressing an endogenous regressor on the first-stage fitted values of the remaining endogenous regressor and other exogenous regressors. The residuals from this regression are then regressed on the instruments. Joint significance of the instruments provides evidence against weak identification for the particular endogenous regressor. Table 6.5 shows that weak identification is rejected for both endogenous regressors. These results show that retirement ages are important predictors of both part-time and full-time work status even when we control for a general nonlinear smooth function of age.

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<sup>31</sup>We also estimated specifications including dummies for marital status and white-collar jobs but these were insignificant and including them did not change anything else.

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**Table 6.5**

Results for first stage FE model explaining part-time and full-time work status

	01-34 hr		35-70 hr	
	Coef	p-val	Coef	p-val
Btw 62 and 65	0.035	0.000	-0.122	0.000
Btw 65 and 70	0.040	0.001	-0.169	0.000
Over 70	0.036	0.016	-0.146	0.000
Btw 62 and 65 (S)	-0.004	0.493	-0.026	0.000
Btw 65 and 70 (S)	-0.030	0.002	-0.015	0.167
Over 70 (S)	-0.060	0.000	0.013	0.397
Age	-0.120	0.169	0.922	0.000
Age squared	0.002	0.114	-0.015	0.000
Age cubed	-0.000	0.073	0.000	0.000
Number of children	-0.000	0.977	-0.004	0.348
Constant	2.291	0.206	-17.126	0.000
F-test for six instruments		0.000		0.000
F-test for three age terms		0.000		0.000
AP test of weak identification		0.007		0.000
N observations	41688		41688	
N individuals	11326		11326	

Notes: 1. Linear probability model with fixed effects. 2. S: Spouse. 3. Standard errors are corrected for possible heteroskedasticity or correlation over time for a given individual.

Table 6.6 presents the results of overidentification tests when we consider the retirement eligibility ages of both the respondent and the spouse, which constitute a total of six instrumental variables for two potentially endogenous regressors; Table 6.7 presents the same results when we consider the retirement eligibility ages of the respondent only (three instruments for two regressors). In all regressions with instrumental variables and fixed effects, the test results support the use of these instruments: the null that all moment restrictions are valid is not rejected.

### 6.5.2 Physical and mental health

Table 6.6 presents the baseline results from the estimation of linear probability models with instrumental variables and fixed effects given by Equation (6.6). The estimation makes use of the full set of six instruments introduced above. Regarding labor market participation at the extensive margin, we find that working (either part-time or full-time) has a significant negative effect on self-reported health, in line with the findings of Coe and Zamarro (2011) and Neuman (2008) who showed that those who are retired have better self-reported health in Europe and in the US, respectively. It might be that those who work are suffering from occupational injuries or diseases or from job stress and therefore report poor health, which would imply that it is not working itself but working conditions that are responsible for poor health outcomes. This is consistent with Siegrist et al. (2006) who find that poor psychosocial quality of work is associated with early retirement among older employees across all European countries. On the other hand, working itself may also initiate adverse health effects which would be delayed or prevented if the individual was retired.

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Working substantially reduces the body mass index, implying that older people who work are much less likely to be overweight or obese than those who are retired, probably because they are physically more active. Consequently, older workers might be expected to be less prone to diseases caused by overweight. In fact, Liu et al. (2009) find that partial retirees have fewer chronic diseases like heart problems or functional limitations than full retirees. Must et al. (1992); Blair and Brodney (1999); Janssen (2007) show that overweight and obesity are related to morbidity. Haslam and James (2005) argue that overweight and obesity considerably increase the risks of cardiovascular disease, diabetes, and cancer. This result is particularly important because a substantial fraction of the population is suffering from being overweight or obese. Table 6.4 showed that almost 42 percent of the sample is overweight and 26 percent is obese. Flegal et al. (2010) report that among those aged 60 or older, from 1999–2000 to 2007–2008, obesity increased from 31.8 percent to 37.1 percent for men, although it decreased from 35 percent to 33.6 percent for women.

We find that those who work rate their memory lower. Workers may indeed be failing to utilize their memory skills more frequently than those who are retired, but this might be because they are more frequently challenged to utilize their memory skills. Hence, working itself may not necessarily be deteriorating memory skills.

Unlike Coe and Zamarro, we find that working has no significant effect on the objective health index. Besides, we find no statistical evidence that the number of hours worked is endogenous in the regressions of word recall score and depression score. Therefore, we estimate a linear model similar to that given by Equation (6.3) except that we allow for fixed effects but do not use instrumental variables. The results are discussed in the next section where we employ alternative estimation methods.

Finally, Table 6.6 shows that the age terms are individually insignificant (due to the collinearity among them) but they are jointly significant at the 0.01 level in all regressions. This might suggest that a cubic function of age captures the evolution of health conditions through older ages better than a linear or quadratic function employed by many of the subject studies (Coe and Zamarro, 2011; Dave et al., 2008; Liu et al., 2009), although the effect of the cubic age term is very small. Results based on a quadratic age function are discussed in the next section.

Regarding labor market participation at the intensive margin, surprisingly, we find that the effect of working part-time is much larger than that of full-time in all regressions and we reject the equality of the coefficients of 01-34 hr and 35-70 hr in the self-reported health, body mass index, and self-rated memory regressions (as indicated in the table with a double dagger symbol (§)). The reason for the results on self-reported health and self-rated memory could be that part-time workers are not only challenged with activities at work, as full-time workers, but also with activities outside work and are therefore more inclined to respond towards poor general health or memory. The result on body mass index is consistent with Au and Hollingsworth (2011). Au and Hollingsworth studied 5164 participants in the Australian Longitudinal Study on Women's Health in 2003 and 2006 to investigate the influence of employment patterns on weight gain and weight loss in young adult women. They found that women in part-time work have a higher probability of losing weight or a lower probability of gaining weight compared to women in full-time work. The authors reason that more time spent at work contributes to weight gain through reduced time available for physical

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**Table 6.6**  
Results for IV-FE model explaining health outcomes

Model	Self-report health		Health index		Body mass index		Self-rate memory		Word recall score		Depression score	
	Coef	p-val	Coef	p-val	Coef	p-val	Coef	p-val	Coef	p-val	Coef	p-val
6 IV, FE, CA, CE, Full												
01-34 hr	1.773	0.003†	0.103	0.584	-4.666	0.004†	1.202	0.011†	2.452	0.222†	0.010	0.989†
35-70 hr	0.531	0.016	0.067	0.347	-1.335	0.027	0.445	0.011	0.747	0.322	-0.087	0.766
Age	-0.017	0.963	0.127	0.259	1.130	0.244	0.243	0.441	1.102	0.365	0.897	0.104
Age sq	0.000	0.959	-0.001	0.338	-0.012	0.440	-0.003	0.534	-0.016	0.412	-0.015	0.090
Age cu	0.000	0.914	0.000	0.285	0.000	0.674	0.000	0.503	0.000	0.496	0.000	0.070
N of chd	-0.013	0.196	0.002	0.613	-0.038	0.183	0.014	0.171	0.046	0.187	-0.017	0.329
N obs	39493		29556		38977		35720		31497		35730	
N ind	9141		7333		9064		8446		7937		8443	
End test		0.000		0.030		0.002		0.002		0.474		0.981
Ove test		0.254		0.355		0.885		0.717		0.445		0.506
F-test		0.000		0.000		0.000		0.000		0.004		0.002
Fem												
01-34 hr	-0.516	0.516†	0.000	0.998	-2.050	0.351†	0.477	0.454†	2.883	0.298†	-1.732	0.203†
35-70 hr	0.123	0.606	0.103	0.265	-1.250	0.077	0.299	0.154	0.153	0.881	-0.350	0.460
Mal	2.167	0.080†	-0.365	0.307†	-1.352	0.576†	0.356	0.669†	-1.883	0.611†	-0.410	0.765†
01-34 hr	0.697	0.110	-0.103	0.409	-0.047	0.956	0.283	0.303	-0.049	0.970	-0.227	0.629
Whi	1.210	0.019†	0.040	0.806†	-4.594	0.002†	0.917	0.038†	3.940	0.038†	-0.245	0.740†
01-34 hr	0.205	0.372	0.034	0.651	-1.285	0.065	0.273	0.165	1.244	0.153	0.033	0.924
35-70 hr	1.828	0.105	0.170	0.619	2.081	0.471†	0.785	0.376	-0.011	0.997†	-1.127	0.460†
Blu	0.779	0.034	0.121	0.303	0.550	0.531	0.550	0.054	0.592	0.628	-0.527	0.288
35-70 hr	1.795	0.028†	-0.257	0.371	-3.553	0.086†	2.039	0.012†	3.058	0.288†	-1.132	0.335†
Led	0.466	0.084	-0.021	0.830	-0.702	0.313	0.595	0.021	0.529	0.587	-0.286	0.485
35-70 hr	1.382	0.055†	0.315	0.219†	-5.205	0.023†	0.172	0.759†	1.192	0.649†	0.930	0.352†
Hed	0.383	0.228	0.075	0.495	-1.826	0.058	0.197	0.414	0.777	0.488	-0.063	0.890
35-70 hr												

Notes: 1. CA: Cubic age. CE: Contemporaneous effect. Full: Full sample. 2. Linear model with instrumental variables and fixed effects. 3. Self-reported health: 1 (Excellent), ..., 5 (poor). Health index takes similar values. Body mass index takes values from 10.9 to 32.7. Higher values indicate increasing body weight. Self-rated memory: 1 (Excellent), ..., 5 (poor). Word recall score takes values from 0 to 20. Higher values indicate better memory. Depression score takes values from 0 to 8. Higher values indicate more severe depression. 4. Endogeneity test tests the null hypothesis that the variables 01-34 hr and 35-70 hr are exogenous. Overidentification test tests the null hypothesis that all instruments are uncorrelated with the unobserved error. F-test tests the null hypothesis that the coefficients of the age terms are zero. 5. Standard errors are corrected for possible heteroskedasticity or correlation over time for a given individual. 6. The regressions on categories also include age terms and number of children. 7. The dagger symbol (†) indicates the cases where we find no statistical evidence that the number of hours worked are endogenous. The double dagger symbol (‡) indicates the cases where equality of the coefficients of 01-34 hr and 35-70 hr is rejected.



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activity, overeating due to work related stress, reduced sleep, or increased preference for fast-food instead of home-cooked meals.

A potential shortcoming of our model is that it is not flexible enough to capture differences in the treatment effects across socio-economic groups. To see if such differences play a role, we run separate regressions for each category of a certain control variable. The second panel of Table 6.6 shows the effects of working part-time and full-time by gender, occupation type, and education level. As found for the full sample above, the effect of working part-time is often larger than that of working full-time and the difference between the two effects is sometimes statistically significant in the regressions of self-reported health, body mass index and self-rated memory (as indicated with the symbol ‡). Second, we find significant effects for white collar part-time workers in all regressions except in the regression for depression score. For example, white collar part-time workers recall about four more words than their fully retired counterparts. Rohwedder and Willis (2010) also find that retirement has a significant negative effect on the number of words recalled, using the HRS data from 2004. Our results suggest that working, instead of retirement indeed has a positive effect on word recall but this effect depends particularly on the occupation type and the number of hours worked. Moreover, white collar part-time workers also have a substantially lower body weight than their counterparts who are fully retired. Current and former blue collar workers do not appear to have significantly different body weights perhaps because former blue collar workers were always physically active during their career years and are less likely to gain weight when they retire.

### 6.5.3 Robustness checks

#### Age specification

Our econometric model has allowed for a cubic function of age to capture the possibly nonlinear changes in the health status due to advancing age. Table 6.6 showed that the three age terms are jointly significant at the 1% level. The top panel of Table 6.7 presents the coefficient estimates of the variables 01-34 hr and 35-70 hr when we employ a quadratic, instead of a cubic, function of age. The table shows that the effect of working part-time is slightly more significant and the effect of working full-time turns out to be significant in the regressions of health index – as in Coe and Zamarro (2011) who considered a quadratic function of age in an instrumental variable model – and word recall score, apparently because the predictive power of the retirement eligibility ages has increased, especially for full-time work hours. Note also that, according to the test for exogeneity, the number of hours worked is now endogenous in the word recall score and depression score regressions. Similarly, the effect of working full-time turns out to be significant in the self-reported health, health index, self-rated memory and word recall regressions on the sub-samples defined by gender, occupation type, and level of education. Overall, these results show that our previous findings for the effects of working part-time or full-time are robust to the age specification in the self-reported health, body mass index and self-rated memory regressions. The effects are sensitive to the age specification in the health index and word recall score regressions.

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**Table 6.7**  
Robustness checks

Model	Self-report health		Health index		Body mass index		Self-rate memory		Word recall score		Depression score	
	Coef	p-val	Coef	p-val	Coef	p-val	Coef	p-val	Coef	p-val	Coef	p-val
6 IV, FE, QA, CE, Full	01-34 hr	1.803	0.002†	0.138	0.447	0.003†	1.263	0.007†	2.836	0.143	0.304	0.678
	35-70 hr	0.557	0.000	0.111	0.024	0.004	0.523	0.000	1.122	0.027	0.263	0.172
	End test	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.087	0.087	0.025	0.025
	Ove test	0.276	0.276	0.349	0.349	0.893	0.893	0.709	0.404	0.404	0.673	0.673
Fem	01-34 hr	-0.360	0.642	0.037	0.876	0.345†	0.559	0.371	3.573	0.191†	-1.310	0.323
	35-70 hr	0.323	0.012	0.147	0.008	0.016	0.465	0.000	1.063	0.070	0.382	0.141
	01-34 hr	2.172	0.060†	-0.293	0.379	0.309†	0.455	0.586	-1.632	0.634†	-0.120	0.928†
	35-70 hr	0.708	0.029	-0.020	0.834	0.227	0.386	0.079	0.101	0.915	0.020	0.955
Whi	01-34 hr	1.271	0.014†	0.059	0.718	0.002†	1.030	0.024	4.001	0.035	-0.124	0.867†
	35-70 hr	0.386	0.012	0.089	0.085	0.007	0.530	0.000	1.548	0.006	0.223	0.308
	01-34 hr	2.129	0.069	0.295	0.419	0.618†	0.720	0.395	-0.693	0.844†	-0.934	0.531†
	35-70 hr	0.661	0.011	0.162	0.061	0.086	0.338	0.063	0.004	0.996	-0.030	0.927
Led	01-34 hr	1.957	0.014†	-0.136	0.613	0.054†	2.060	0.008†	3.599	0.188†	-0.861	0.439
	35-70 hr	0.547	0.003	0.086	0.208	0.067	0.601	0.000	0.840	0.187	0.054	0.834
	01-34 hr	1.462	0.044†	0.342	0.181	0.025†	0.269	0.643	1.337	0.607†	1.232	0.226†
	35-70 hr	0.539	0.018	0.134	0.090	0.041	0.357	0.042	1.108	0.162	0.480	0.135
CA, CE, Full, Pool OLS	01-34 hr	-0.435	0.000†	-0.189	0.000†	0.000†	-0.186	0.000†	0.750	0.000†	-0.342	0.000†
	35-70 hr	-0.478	0.000	-0.247	0.000	0.000	-0.219	0.000	0.540	0.000	-0.455	0.000
	01-34 hr	-0.109	0.000	-0.058	0.000†	0.643	-0.029	0.051†	0.079	0.163	-0.110	0.000
	35-70 hr	-0.130	0.000	-0.079	0.000	0.335	-0.067	0.000	0.088	0.102	-0.131	0.000
Pool 6 IV	01-34 hr	2.732	0.025†	0.424	0.288†	0.228†	3.502	0.004†	-7.997	0.108	-1.287	0.295†
	35-70 hr	0.789	0.035	-0.018	0.869	0.331	0.909	0.016	-3.892	0.006	-0.637	0.104
	End test	0.000	0.000	0.166	0.000	0.236	0.000	0.000	0.000	0.000	0.631	0.004
	Ove test	0.936	0.936	0.000	0.000	0.223	0.271	0.271	0.000	0.000	0.004	0.004
3 IV, FE, CA, CE, Full	01-34 hr	1.409	0.066	0.066	0.777	0.147†	0.561	0.353	3.342	0.235†	-1.264	0.294†
	35-70 hr	0.533	0.019	0.060	0.441	0.239	0.346	0.054	1.003	0.253	-0.223	0.536
	End test	0.003	0.003	0.021	0.021	0.302	0.026	0.026	0.477	0.477	0.433	0.433
	Ove test	0.986	0.986	0.706	0.706	0.218	0.603	0.603	0.102	0.102	0.471	0.471
6 IV, FE, CA, LE, Full	01-34 hr	2.537	0.034†	0.359	0.270	0.068†	0.110	0.888†	1.096	0.721†	-0.522	0.735†
	35-70 hr	0.804	0.026	0.138	0.156	0.095	0.189	0.437	0.130	0.896	-0.179	0.706
	End test	0.004	0.004	0.079	0.079	0.050	0.463	0.463	0.909	0.909	0.922	0.922
	Ove test	0.752	0.752	0.848	0.848	0.369	0.641	0.641	0.993	0.993	0.848	0.848
6 IV, FE, CA, CE, P ret	01-34 hr	2.083	0.006†	0.057	0.814	0.006†	1.609	0.012†	1.466	0.514†	0.319	0.743†
	35-70 hr	0.710	0.012	0.050	0.577	0.014	0.649	0.006	0.685	0.442	0.018	0.962
	01-34 hr	2.465	0.023†	0.263	0.427	0.025†	2.300	0.032†	1.824	0.638†	0.507	0.727†
	35-70 hr	-0.067	0.719	0.014	0.791	0.944	0.014	0.945	0.079	0.898	-0.302	0.309

Notes: 1. QA: Quadratic age. CA: Cubic age. CE: Contemporaneous effect. LE: Lagged effect. Full: full sample. 2. Self-reported health: 1 (Excellent), ..., 5 (poor). Health index takes similar values. Body mass index takes values from 10.9 to 82.7. Higher values indicate increasing body weight. Self-rated memory: 1 (Excellent), ..., 5 (poor). Word recall score takes values from 0 to 20. Higher values indicate better memory. Depression score takes values from 0 to 8. Higher values indicate more severe depression. 3. Endogeneity test tests the null hypothesis that the variables 01-34 hr and 35-70 hr are exogenous. Overidentification test tests the null hypothesis that all instruments are uncorrelated with the unobserved error. 4. Standard errors are corrected for possible heteroskedasticity or correlation over time for a given individual. 5. The regressions on categories also include age terms and number of children. 6. The dagger symbol (†) indicates the cases where we find no statistical evidence that the number of hours worked are endogenous. The double dagger symbol (‡) indicates the cases where equality of the coefficients of 01-34 hr and 35-70 hr is rejected.

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### Estimation method

Our econometric model makes use of instrumental variables to circumvent the endogeneity of hours worked, and exploits the panel nature of the data to allow for fixed effects that control for unobserved individual heterogeneity. To show the extent to which the endogeneity of hours worked and individual heterogeneity affect the estimated coefficients, the middle panel of Table 6.7 presents the results using three alternative estimation methods. The first is pooled OLS estimation, the second is the panel FE estimation which uses the within groups estimator (the within group transformation followed by OLS), and the third is the pooled IV estimation which uses a generalized method of moments estimator. The baseline panel IV-FE estimation in Table 6.6 uses the two-stage least-squares estimator after the within group transformation. A first result is that the signs or magnitudes of the coefficients generally change when we control for the endogeneity of hours worked, especially when we control for fixed effects. The changes are somewhat less pronounced, for example, in the regressions of the word recall and the depression score, where we find no statistical evidence that the number of hours worked is endogenous. These results suggest that health conditions, as measured by self-reported health, body mass index and self-rated memory, not only affect the labor market participation decisions of individuals but also affect labor supply at the intensive margin. The second result is that the magnitudes of the effects decrease substantially when we control for fixed effects, regardless of whether we take an instrumental variables approach. This result suggests that individuals have health related unobserved characteristics that are also correlated with their labor market behavior. Overall, the results suggest that controlling for the endogeneity of hours worked and individual heterogeneity are essential in the analysis of the effect of labor market behavior on health outcomes at older ages.

Baseline analysis on panel IV-FE estimation in Table 6.6 showed that the number of hours worked is not endogenous in the regressions of word recall and depression score. Therefore, we rely on the results based on the panel FE estimation that are presented in the middle panel of Table 6.7. We find no significant effect for word recall score but for depression score. The table shows that part-time and full-time workers are equally less likely to be depressed than retirees. This suggests that even working at a reduced work effort helps to prevent symptoms of depression. Separate regressions for the eight symptoms that constitute the depression score show that working has a significant negative effect on the following four symptoms of depression: everything is an effort, sleep is restless, felt alone, and could not get going.

### Instrument set

Coe and Zamarro (2011) and Rohwedder and Willis (2010) have used retirement eligibility ages of the respondent as instruments for retirement behavior. We have supplemented this instrument set with the retirement ages of the spouse. In order to investigate the sensitivity of the estimates for restricting the set of instruments, the third panel of Table 6.7 presents the results using the retirement ages of the respondent only. The overidentification test results indicate that multiple exclusion restrictions on the three instruments is not rejected meaning that the instruments are exogenous to the health status of the respondent. As

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in the case when we use the full instrument set, the number of hours worked appears to be exogenous in the regressions of word recall and depression score. However, the number of hours worked also appears to be exogenous in the regression of body mass index. In the other regressions, the coefficients generally preserve their signs or magnitudes but they are less precisely estimated, perhaps due to the reduction in the predictive power of the instrument set. We conclude that the retirement ages of the spouse improve the efficiency of the instrumental variables estimator yielding more significant effects.

### Lagged effect of retirement

We have examined the contemporaneous effect of labor market participation and hours worked on health outcomes. A concern is that retirement, in comparison to working, may have a lagged rather than a contemporaneous effect on health. For example, cognitive skills of a retiree may deteriorate, and hence differ from those of a current worker, only after a number of years spent in retirement (Rohwedder and Willis, 2010; Bonsang et al., 2012). The bottom panel of Table 6.7 presents new results on the contemporaneous effects of part-time and full-time work on health when we require that part-time and full-time workers were also working part-time and full-time and retirees were also retired two years ago, i.e. when they were interviewed in the previous survey wave. We find no significant change in the results of the regressions of self-reported health and body mass index, when compared to the baseline results in Table 6.6. However, we do not find anymore evidence that the number of hours worked is endogenous in the regression of self-rated memory.

### Definition of part-time work

In our analysis so far, we defined part-time work as working less than 35 hours per week. In the HRS survey, however, working under 35 hours can correspond to two different labor force participation statuses: ‘working part-time’ as well as ‘partly retired’. That is, the survey determines the labor force status of a respondent as ‘working part-time’ if he or she is working under 35 hours (based on reported hours of work) and does not mention retirement (based on reported retirement status), while it determines the status of the respondent as ‘partly retired’ if he is working under than 35 hours, or looking for a part-time job, and mentions retirement. Therefore, we check if the effect of working under 35 hours in our baseline analysis change among those who are partly retired and those who are working part-time at any given survey year.

Table 6.3 presented the fraction of individuals in part-time employment before and after the age they become eligible for social security where part-time status is based on reported hours of work. When we differentiate between the two definitions of part-time status, we find that the fraction of those partly retired increases while that of those working part-time decreases when individuals become eligible for social security. For example, the fraction of those partly retired increases from 4.48 percent among those under age 62 to 12.33 percent among those between ages 65 and 70, while the fraction of those working part-time decreases from 11.51 percent among those under age 62 to 4.79 percent among those between ages 65 and 70. A potential explanation is that, among those working less than 35 hours, more people report being retired and are therefore categorized as ‘partly retired’ at older ages.

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The implication of this result for the baseline IV-FE estimation is the following. We repeat the estimation on two restricted sub-samples of the data. We require that those working less than 35 hours at any given survey year to be partly retired in the first sub-sample, and to be working part-time in the second sub-sample. With respect to the first stage results, we find that the effects of the retirement ages of the respondent on the probability of part-time work are significant and positive and larger than those presented in Table 6.5 in the first sub-sample, while they are insignificant and negative and smaller than those presented in Table 6.5 in the second sub-sample. The effects of the retirement ages of the spouse on the probability of part-time work also become less significant or insignificant in the second sub-sample. We find no significant change for the effects on the probability of full-time work. The bottom panel of Table 6.7 presents the second stage results from the estimations based on the two sub-samples. In the regressions of self-reported health, body mass index and self-rated memory, the signs and significance of the coefficient estimates are similar across the two sub-samples, but the magnitudes of the estimates are larger in the second sub-sample. It might be that part-time workers more often take part in work or non-work activities that are physically or mentally demanding than those partly retired, which might explain why they have a lower body weight and a tendency to report worse overall health or memory.

### 6.6 Conclusion

We analyzed the causal effect of working part-time or full-time on the physical and mental health of US residents between ages 50 and 75, controlling for fixed individual effects and potential endogeneity of labor supply. The two main findings are the following. First, relative to the retired, part-time or full-time workers rate their overall health and memory lower, while part-time white collar workers have a better word recall score. On the other hand, full-time and, especially, part-time workers have a much lower body weight. Considering that 68% of our sample consists of individuals who are overweight or obese, promoting partial retirement among the elderly workers seems essential as those who are fully retired appear to be much more prone to be overweight or obese and perhaps to the related diseases such as a heart attack. We also find that part-time and full-time workers are less prone to the symptoms of depression.

Second, the effect of working on health is larger for part-time workers than full-time workers. For example, part-time workers have a much lower body weight in comparison to full-time workers. This result suggests that the effect of number of work hours on health is nonlinear in old age. It might that part-time workers take part in work activities but also in non-work activities which when combined are physically and mentally more challenging than only taking part in full-time work activities. In this respect, analysis of time use data would be particularly useful to understand the differences in time allocation among work and non-work activities of part-time and full-time workers. It might also be worthwhile to distinguish between the effects of voluntary and involuntary retirement, since it has been shown that these transitions have different effects on the way in which a person experiences retirement and therefore possibly also on health (van Solinge and Henkens, 2007). Unfortunately this cannot be done with the data at hand. Finally, it might be useful to consider additional

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measures of health or other longitudinal datasets in other countries to further investigate the differences between the effects of part-time and full-time work on health.

## 7 Conclusions

The five essays in this dissertation address a range of topics in the micro-economic literature on partial retirement. The main contributions of the essays and future research directions are discussed below.

Chapter 2 contributes with a review of the micro-economic literature on partial retirement. In addition to the literature review, it analyzes the prevalence of partial retirement in the United States and a number of European countries and analyzes the relevance of partial retirement in the Netherlands as a tool to keep people employed longer.

Two potential research directions are the following. First, as it is discussed in the chapter, partial retirement has the potential to extend the employment years and sustain the pension system by extending the contribution periods and reducing the number of years during which full benefits are claimed. Promotion of partial retirement by policy makers clearly depends on the effect of partial retirement on total labor supply. However, empirical evidence on the labor supply effect of partial retirement is still scarce and more research is needed in this direction. Second, our literature review indicates that partial retirement is much less studied in Europe than in the United States. The Survey of Health, Ageing and Retirement in Europe (SHARE) seems particularly well suited for an analysis of partial retirement in the European countries. The data includes information on a rich set of labor market variables but also health indicators on the same individuals for multiple years in fifteen European countries and the panel structure of the data allows for explaining the heterogeneity in partial and full retirement decisions across individuals and countries.

The contribution of Chapter 3 is a thorough analysis of the implications of partial retirement for net replacement rates in a defined benefit system. It computes net replacement rates both in partial retirement scenarios and early and late full retirement scenarios and carries out a comparative analysis across these different retirement scenarios. It then examines the economic determinants of these replacement rates in these scenarios. As such, the analysis gives an indication of the financial well-being of older workers in partial retirement compared to those in full retirement.

The analysis in this chapter is based on an assumed amount of work income and working career for a hypothetical worker, however. Future research might consider data on actual workers. Data on labor income and pension entitlements are becoming available in the form of register data from the pension funds in the Netherlands. Such data would allow to identify the variation in replacement rates in the population with respect to worker characteristics, or to carry out policy simulations on the replacement rates with respect to the changes in the parameters of the underlying pension system.

The contribution of Chapter 4 is twofold. First, it analyzes stated preference data to elicit the true preferences of individuals for partial and abrupt retirement plans. Second, it carries out a randomized controlled experiment to study how financial incentives and disincentives affect partial and abrupt retirement decisions. The results show that many people prefer partial retirement at the same job over the early or late abrupt retirement

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and that financial incentives and disincentives affect partial or abrupt retirement decisions. The findings suggest scope for policy interventions to place particular emphasis on partial retirement plans which provide flexible solutions to employees optimizing their retirement paths.

The chapter shows that the use of stated preference data to explain the labor market decisions of older workers is promising. In particular, it shows that stated preference data can be used to elicit the true preferences for different kinds of retirement plans, but also to carry out economic experiments to simulate the effects of possible policy interventions on retirement decisions. It is difficult to carry out such analyses using data on actual retirement decisions because the retirement choices available to employees are not always observed, or it is difficult to observe policy interventions that cause sufficiently large variations in financial incentives or disincentives to affect retirement decisions. The stated preference data at hand can also be used in a structural life-cycle model, in which life time utility is a discounted sum of within period utilities driven by consumption expenditures and leisure. On the basis of such a model, it is possible to forecast choices among scenarios that are not asked in the stated preference questions, with, for example, different part-time factors or longer or shorter periods of part-time work. These demonstrate the potential uses of stated preference data in future research.

It is well documented that employees are limited in their opportunities for partial retirement. However, there is little empirical evidence explaining the specific factors that limit the opportunities for partial retirement. Chapter 5 contributes by providing evidence for certain types of restrictions that might limit the access to partial retirement. In addition, it provides evidence for certain factors that might make partial retirement less attractive for workers. It also shows how these restrictions are associated with worker characteristics, job characteristics and job satisfaction.

The literature would clearly benefit from further evidence on the restrictions on partial retirement. In this respect, a survey of employers would be particularly informative as it would provide a direct way of learning about the restrictions on partial retirement because the conditions and terms of employment can be effectively analyzed at their source with the human resource managers of establishments. The few studies analyzing the restrictions on partial retirement are all conducted in the United States. It seems essential to learn about the restrictions on partial retirement in the European countries where partial retirement is considered to be a potential policy tool to keep people at work beyond the effective or official retirement ages. Another interesting future research direction is to compare the restrictions on part-time work among younger and older workers to better understand the types of restrictions that are specially related to age.

Chapter 6 contributes to a growing literature on the effects of retirement on mental and physical health. It examines how the amount of work hours, as opposed to retirement, affects the physical or mental health conditions of older US residents. It shows that part-time or full-time work lowers overall health and memory skills, but leads to a much lower body mass index than full-time retirement. In addition, it shows that these health conditions respond much more to working part-time than to working full-time. Increasing life expectancy and the ensuing increase in the official retirement age in many industrialized countries imply that workers will spend more years in the labor market in the future. The results give an



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indication of how working beyond the effective or statutory retirement ages could affect the health conditions of individuals.

It seems worthwhile in future research to consider additional measures of health and other longitudinal datasets in other countries to further investigate the differences between the effects of part-time and full-time work on health. Besides, the differential effects of part-time work versus full-time work on health still need to be explained. We argued that part-time workers might take part in work activities but also in non-work activities which when combined might be physically and mentally more challenging than only taking part in full-time work activities. In this respect, analysis of time use data would be particularly useful to understand the differences in time allocation among work and non-work activities of part-time and full-time workers.

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